MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 38 SEPTEMBER, 1931 Number 1

PRINCIPAL ARTICLES IN THIS NUMBER

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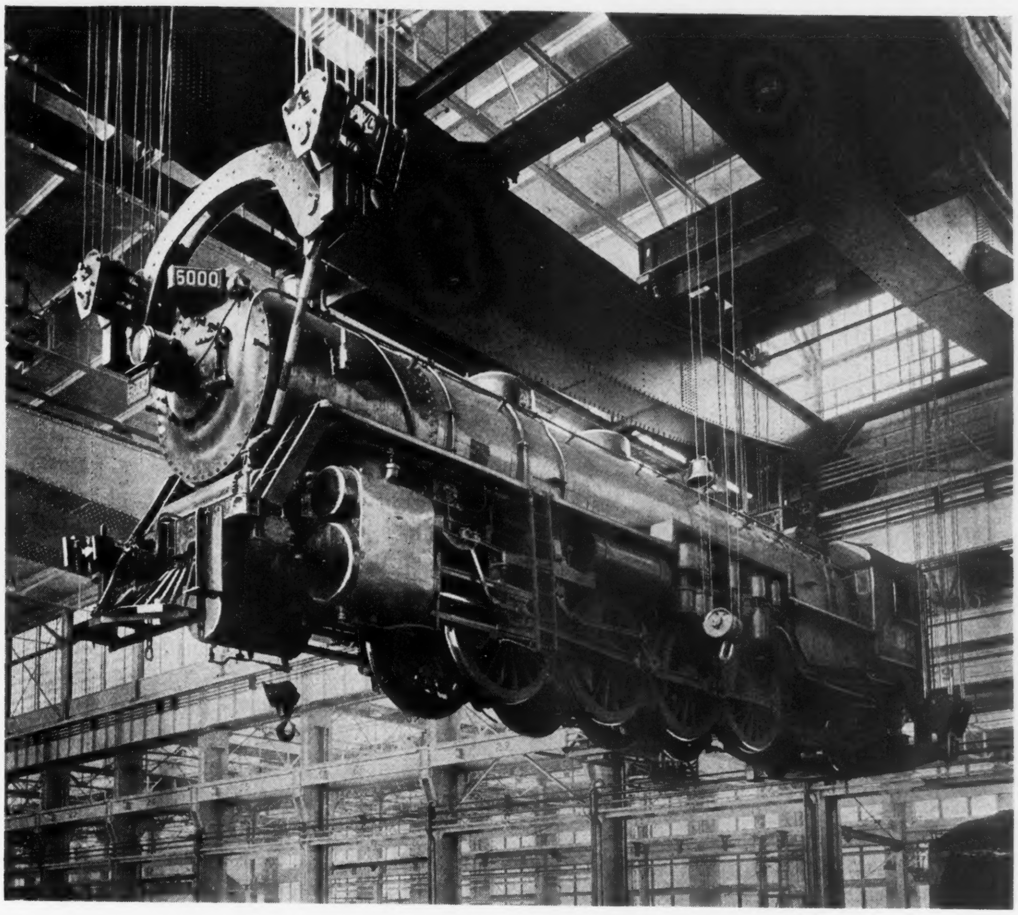


No Obsolete Machines in This Railway Shop

By CHARLES O. HERB

IN planning the new locomotive shop of the Canadian National Railways at Montreal, Canada, many of the machine tools used in the old shop were scrapped in order to obtain the advantages of up-to-date equipment. Traditional practices were freely discarded for better and more economical methods. For example, automatic electric furnaces were selected for expanding tires preparatory to shrinking them on wheel centers; a special machine was installed for grinding the journals of axles; and a combination machine was bought that does both radius-link and internal grinding.

What have been the results? A shop that stands out as a model of efficiency for railway systems the world over; a shop that does better work in less time and at lower cost.

The important advantage obtained by using the automatically controlled electric furnaces for expanding heat-treated tires to permit shrinking them on driving and truck wheels, is that overheating of the tires is impossible. In the past high temperatures frequently affected the temper of heat-treated tires. Furnaces of the same type are also employed for heat-treating spring stock and for

heating spring buckles prior to assembling them over the leaves.

Ground Journals Lengthen Bearing Life

The grinding of journals on all driving wheel and trailing truck axles has been adopted as standard practice, because the smooth surface thus obtained greatly lengthens the life of the journals and bearing brasses. Journal troubles of locomotives in service have been materially reduced since this practice has been put into effect.

Wheel sets are brought to the machine shown in Fig. 2 for this operation. They are held on centers in this machine. If necessary, turning cuts are taken first with tools mounted in the two carriages at the front of the machine, and then the grinding is done with two abrasive wheels mounted on the heads at the rear. These grinding heads traverse back and forth across the work until the desired smoothness and straightness have been obtained. The actual diameter is not important, as the brasses are later fitted to the journals, but the journals must be straight and concentric within 0.002 inch. About 0.020 inch of stock is removed in grinding.

This machine is controlled entirely by push-buttons on a panel in front. The average time for turning and grinding a pair of driving axle journals is about fifty minutes. In the illustration, an axle about 9 inches in diameter is being handled, but many axles are 12 inches in diameter. In addition to the two grinding heads seen, there is a third at the right which is used for finishing the journals of outside bearing truck axles.

Rollers Produce a High Finish on Crankpins

The rolling operation illustrated in Fig. 1 has been adopted for obtaining a smooth, hard surface on crankpins after they have been turned. This operation is performed in a conventional, double-end quartering and turning machine, both crankpins being rolled at the same time. The wheel set remains stationary during the operation.

For the rolling, a head *A* carrying three rollers *B*, is used. For the turning preparatory to rolling, a separate head *C* with two opposed turning tools is employed. Crane *D* facilitates the interchanging of heads *A* and *C* in the machine.

Rollers *B* are adjustable radially for applying the desired pressure on the work as head *A* revolves them around the crankpin and traverses them back and forth over it. In this operation, the metal is slightly compressed, thus producing a smooth hard surface on the crankpin. It has been found that rolled crankpins stand up much longer in service than those that are merely finish-turned, and as the

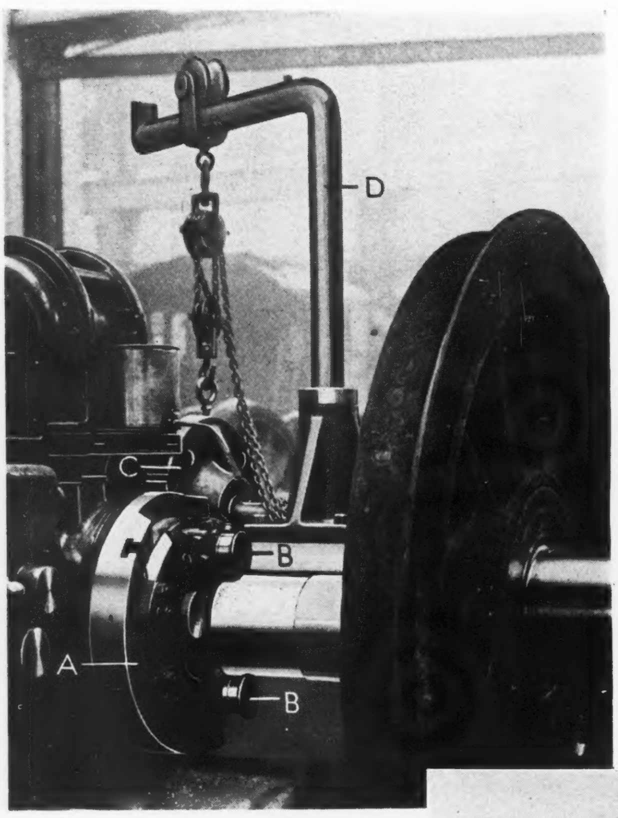


Fig. 1. (Above) A Hard Smooth Surface is Obtained on Crankpins by a Rolling Operation which Succeeds the Turning

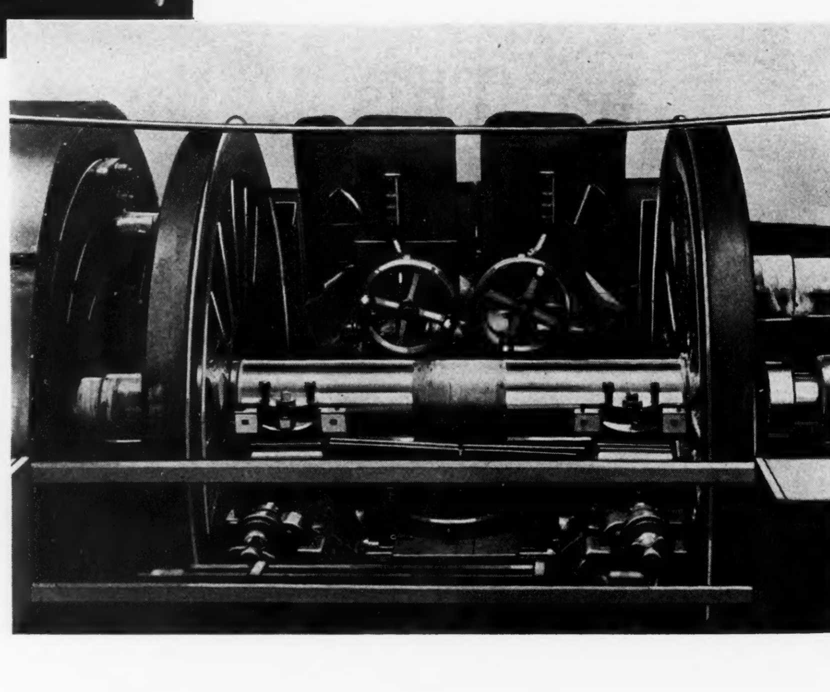


Fig. 2. (Right) The Journals of Driving and Truck Axles are Ground to Obtain a Long-Wearing, Smooth Surface

operation is accomplished in the same machine as the turning, no additional setting-up time is involved. On small crankpins, say 5 inches in diameter by 4 inches long, the operation of turning and rolling requires about fifty minutes. On crankpins from 8 to 9 1/4 inches in diameter by about 20 inches long the time averages between 1 and 1 1/2 hours.

Radius Links and Holes Ground on the Same Machine

Railroad shops in general use a single-purpose machine for grinding the radius links of valve motions. The experience of the Canadian National Railways has been that machines designed especially for this operation are idle a large percentage of the time as there is not sufficient work of this kind to keep them busy. The combination machine illustrated in Fig. 3 has eliminated idle time from this source, because when this machine is not busy on link work, it is employed for the internal grinding of valve motion parts.

The illustration shows this machine set up for grinding several holes in a rocker arm. For this operation, of course, the table remains stationary and the wheel-spindle has an eccentric rotation. If a radius link were to be ground, column *A* would be swiveled 90 degrees to bring the swinging arm *B* toward the grinding-wheel spindle and the bracket at the bottom of the arm would be attached to the table of the machine. The automatic cross-feed of the table would be engaged to swing arm *B* and carry the link past the wheel at the required radius. Also, the mechanism producing the eccentric motion of the wheel-spindle would be disconnected to permit the grinding wheel to revolve on its own axis.

How Solid Guide Bars are Finished

Guide bars of the solid type recently introduced in locomotive practice have a wide slot *A* (Fig. 4) which is finished in this shop by milling on the machine illustrated. The narrow slot *B* is previously slab-milled in this steel forging at the same time as the sides of the forging are milled. In the operation illustrated, one cutter simultaneously mills the top, bottom, and sides of slot *A*. Roughing and finishing cuts are taken, and as the cutter must span the entire slot, separate cutters are required, that is, one cutter for roughing and another cutter for finishing. In each case, there is only one feeding of the work past the cutter.

The large rail-type milling machine shown in Fig. 5 is used for finishing all the flat surfaces on the main- and side-rods. In the operation illustrated, two main-rods, 10 feet long, are being milled

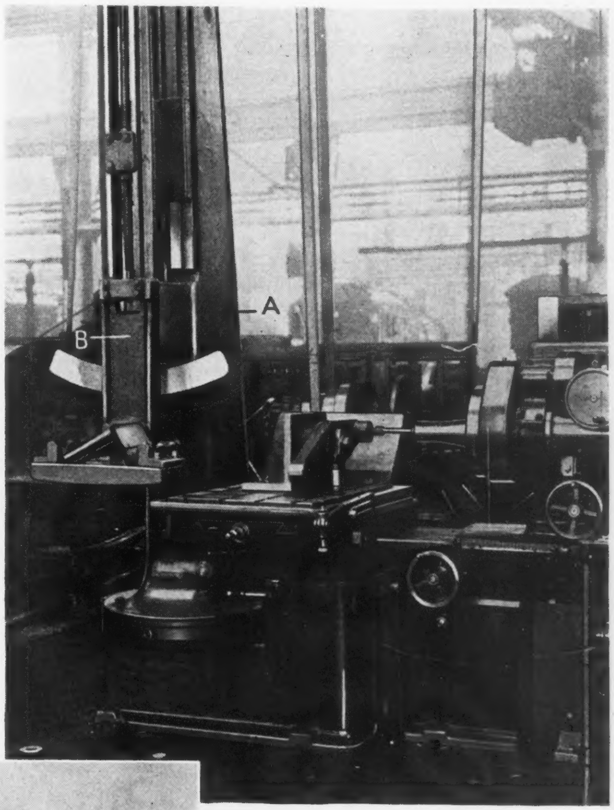


Fig. 3. (Above) The Radius-Link Grinding Machine is also Used for Grinding Holes in Valve Motion Parts

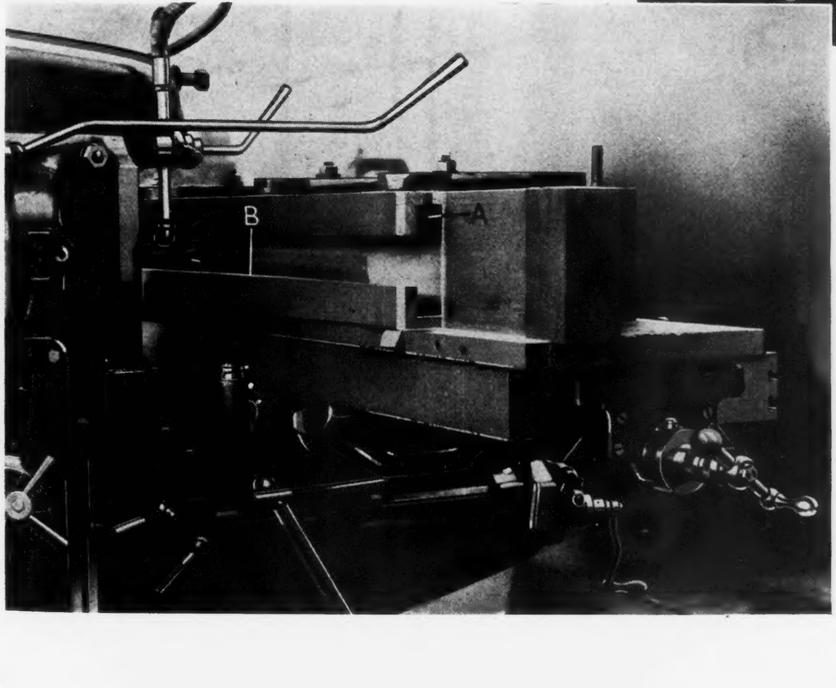
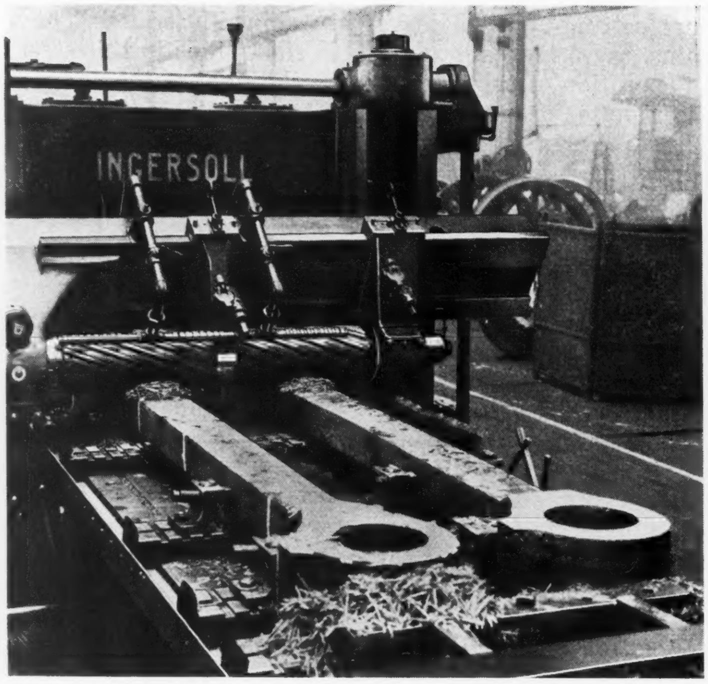


Fig. 4. (Left) The Wide Slot in Guide Bars is Machined at the Top, Bottom, and on Both Sides Simultaneously by One Cutter

Fig. 5. Milling Two Locomotive Main Rods, Ten Feet Long



by helical inserted-blade cutters, each 9 inches in diameter by 24 inches long.

Locomotive Frames Slotted on Three-Head Machine

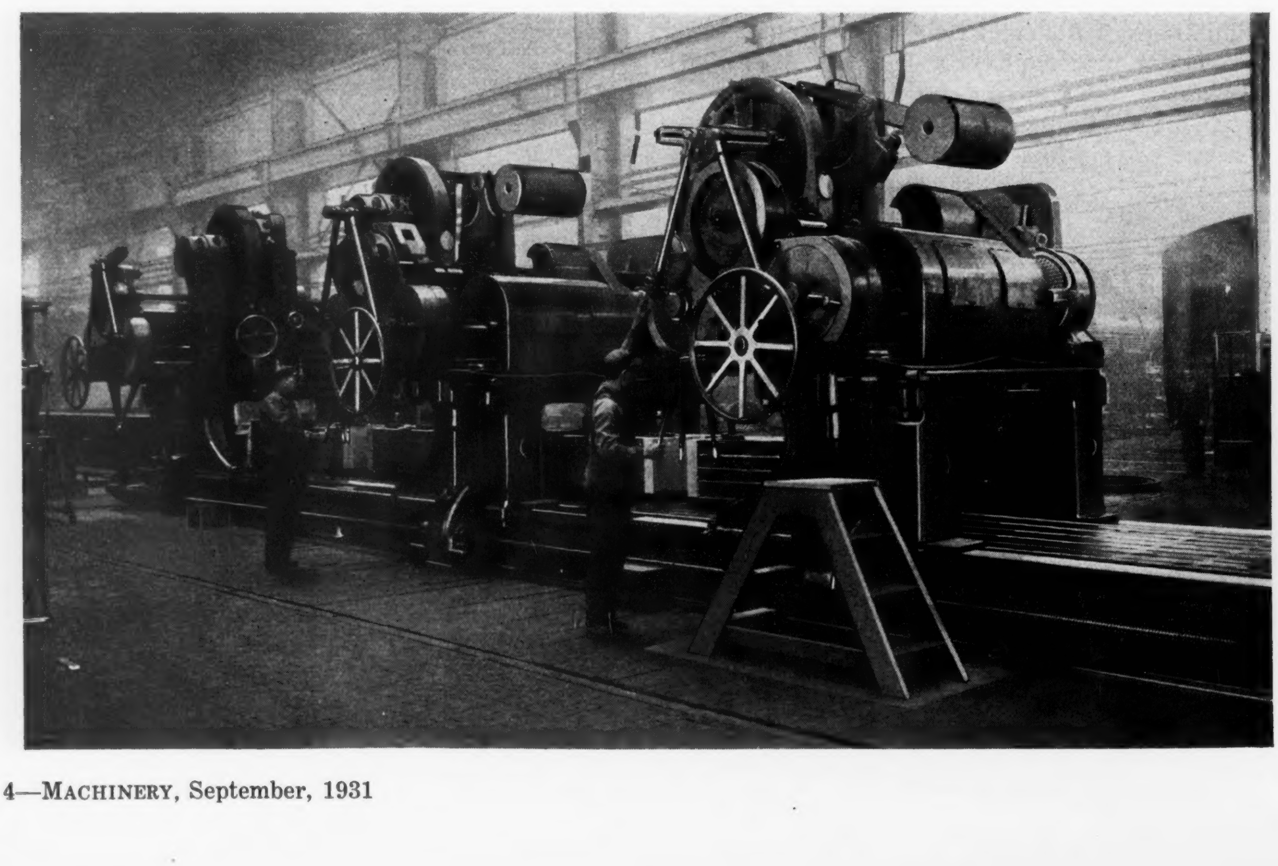
Locomotive frames are slotted, four at a time, on the machine shown in Figs. 6 and 7, to suit the driving-box wedges and shoes, cylinder castings, etc. In fact, practically all the machining of the frames, with the exception of finishing the top and sides and drilling the holes, is done on this machine. The frames are usually vanadium or nickel steel castings ranging up to 6 inches in thickness and 34 feet in length. To speed up production, the machine is provided with three slotting units which are adjustable along the bed. With this arrangement, cuts can be taken simultaneously at different points. The practice is to set up the frames on blocks about 4 inches high so as to provide sufficient space for the slotting heads to pass the bottom frame completely and reverse without striking the table.

A draw-cut shaper having a stroke of 72 inches is used for finishing various plane surfaces on cylinder castings and some other parts. Fig. 8 shows a typical job of this kind.

Turning and Boring Cylinder Bushings

Fig. 9 shows the equipment used for simultaneously turning and boring nickel cast-iron bushings for locomotive cylinders. These bushings range from 20 to 27 inches in inside diameter and up to 43 inches in length. They are generally about 3/4 inch thick, with a 1/16-inch step in the middle of the outside surface. An important feature of this operation is the means employed for feeding the boring head *A* through the work. This head is fed by a screw on which it is mounted, the screw being driven through the telescoping shaft *B*. The lower end

Fig. 6. Three-head Machine which Performs All Slotting Operations Simultaneously on Four Locomotive Frames



of the feed-screw is piloted by a bushing in the center of the machine table, thus insuring straight cylinder surfaces. Head A has three cutters.

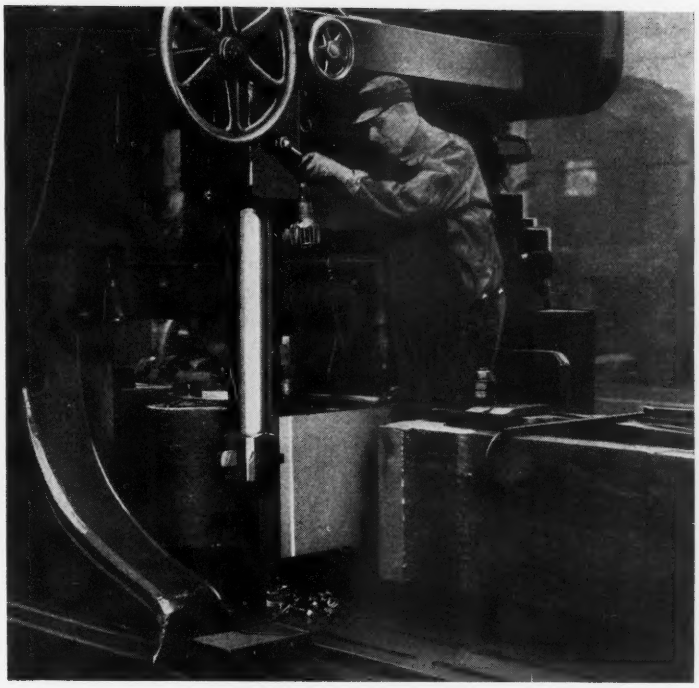


Fig. 7. Machining a Jaw in Four Frames at One Time

Auxiliary Crane for the Assembly of Connecting-Rods

Complete locomotives are carried into and out of the erecting bay by an overhead crane of 200 tons capacity, in the manner shown in the heading illustration. This crane runs on two trucks having center-to-center distances of 25 feet. Running on the girders of this large crane there is an auxiliary crane of 10 tons capacity which is of considerable assistance in assembling the main- and side-rods. While the big crane lifts the locomotive several inches above the track so that the wheels can be turned to facilitate the assembly of the rods, hooks on the auxiliary crane can be conveniently employed for raising and holding each rod until fitted into place.

The locomotive shown in this illustration has a total weight of 354,000 pounds, not including the tender, which weighs approximately 241,000 pounds. The driving wheels of this locomotive are 73 inches in diameter.

Engines of this huge type require only six hours to pull the crack train of the Canadian National Railways—The International Limited—from Montreal to Toronto, a distance of 334 miles. The time includes the delays in making four stops. Including the time for the stops, the average speed over this run is 55.7 miles per hour. For the distance run, the train is the fastest in America.

Fig. 8. A Draw-cut Shaper Finishes the Plane Surfaces of Cylinder Castings

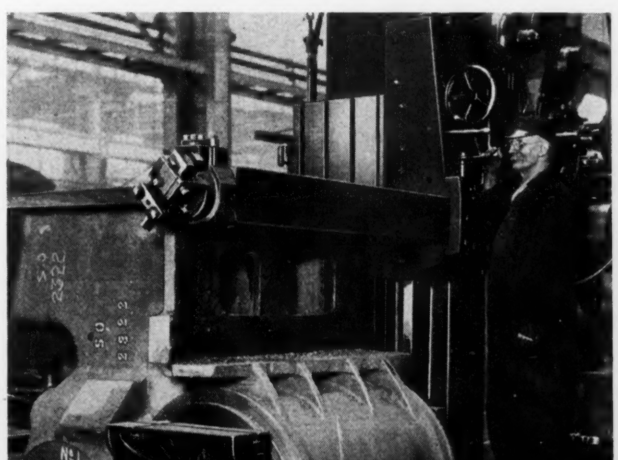
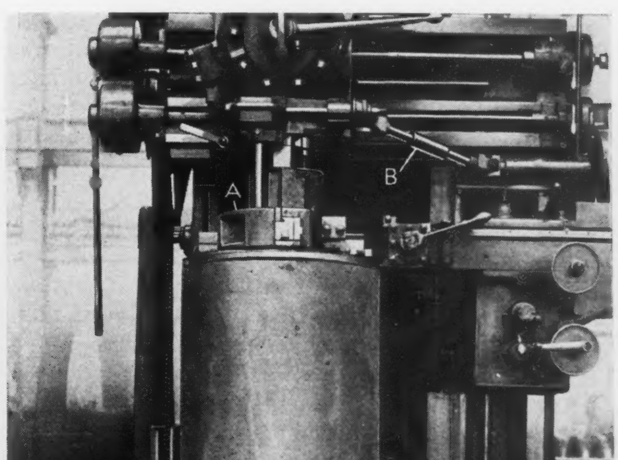


Fig. 9. Large Cylinder Bushings are Bored and Turned Simultaneously



Keeping Delivery Schedules Up to Date

The Use of a Form or Chart that Shows at Any Time the Status of All Orders to be Filled

By S. A. SMITH, Manager, Gear Department
Meisel Press Mfg. Co., Boston, Mass.

THE chart or form shown in the illustration enables one to keep fully informed on the status of a customer's order. It shows at any time the total number of parts shipped, the balance due, and any special information pertaining to the order. The form consists of a loose-leaf page made to fit any size book desired, from letter size for desk use down to pocket size suitable for carrying about the plant. This form has been evolved after several years of practical application in the plant of the Meisel Press Mfg. Co.

Lines 1 to 15 cover the particular needs of this company, but these and other parts of the form can readily be changed to meet the requirements of any business. The essential feature is to have, in compact form, all the data that will be required in following the progress of the work, so that it is unnecessary to refer to the customer's order or correspondence or make lengthy calculations.

The clerk who writes the order has in his possession all the blueprints and correspondence and the customer's order. He enters on the form the data ordinarily required to fill the order. If he does not know what the shop practice would be in handling the work—for example, what allowances should be made for cutting up material—he confers with someone in the shop. He fills in and sends one of these forms with each order to the production manager. This is done whether the order is large or whether but a single piece is required. In the case of a single piece, the shipping date is given, but only a small part of the form need be filled in.

The entries should be made after each shipment and should be available for the executives by a certain hour each day. The loose leaves are placed in the book in sequence, according to the blueprint numbers. Tabs with the numbers could be used at the edge of the page as an index, but this is not necessary. This practice, however, would be useful when there are a large number of blueprints for each customer. When there are a large number of customers and each has only one or a few blueprints, the pages can be arranged alphabetically according to the names of the customers. Alphabetical indexes can then be employed and the blueprints for each customer can be inserted in sequence according to their numbers.

If desired, the book can have two sections, one alphabetically arranged according to the customers' names, and the other numerically arranged according to the numbers on the blueprints. The numbers at the extreme left-hand side of the form used for reference in explaining the purpose of each line, can be omitted and the space utilized in the form itself.

The purpose of the lines from 1 to 5 can readily be understood. It will be noted that the order number, the blueprint number, the description of the part, and the inspection requirements are all grouped closely together so that they can be seen at a glance. Space for the blueprint number is located near the right-hand side of the page, so that it can be seen readily when the book is opened.

Line 4 provides for two revisions in the quantity originally ordered. Line 5 gives the number of pieces required in each unit and the number of units that can be made from the total quantity or number of pieces ordered. There is also space enough to permit changing the quantity of units specified by crossing out the first quantity and inserting the revised amount.

A check-mark or cross can be placed after the notations "Navy," "Army," "None" in line 5 to indicate which is applicable to the order. Lines 6 and 7 are self-explanatory. Lines 8 and 9 show how the total number of feet required, as indicated in line 7, was computed. This enables the same method to be used in making replacements for any number of pieces and thus eliminates errors from guesswork, due to lack of information, and prevents loss of time in getting in touch with the clerk who originally furnished the data for ordering the material.

Line 10 shows the basis on which extra material is provided for contingencies. The percentage can be varied, of course, to suit the practice of different organizations. Lines 11, 12, 13, and 14 record the material received, and while the information as to "quantity" and "bars" might be combined in one column, it is the practice of this company to keep this information separate in the event that it is desired to record the number of pieces that can be made from the material received.

Line 15 shows the total amount of material received, and from the example shown, it will be noted that 105 feet 16 inches, or 106 1/3 feet, have been received. This agrees with the requirements noted in line 7. Lines 16 and 19 have spaces numbered from 1 to 31 to correspond with the number of days in the longest months. Lines 17 and 20 are left blank and filled in to suit the delivery requirements of the order.

The example shown is based on shipping two hundred pieces a month. Assuming that a month has 26 working days, divide 200 pieces by 26, which gives 7.7 pieces per day as a production quota, or say 8 pieces. At the termination of the first working day, 8 pieces should have been made, and at the termination of the second working day, 16 pieces should be completed, and so on progressively

until on the twenty-sixth working day, 208 pieces will have been completed.

Suppose, for example, that on the 18th of the month a total of 140 pieces had been shipped, whereas, according to lines 19 and 20 on the form, 144 pieces should have been shipped at the end of eighteen working days. It would appear that the shipments are four pieces behind schedule. However, we must take into consideration the fact that the 18th of the month is not the eighteenth working day, since two Sundays intervene, and that in reality only sixteen days have been available. Thus, if we look at the schedule for sixteen days, we will find that 128 pieces should have been completed in that time, so that as a matter of fact, the production is 12 pieces ahead of requirements.

1	Customer's Name John Brown		Blueprint No. 30		Part No. 6	
2	Customer's Order No.	Dated 11/10/30	Meisel Order No. 50479		Dated 11/12/30	
3	Customer's Name of Part Mainshaft Gear		Description Bevel Gear 68T 8/10 P.			
4	Quantity Ordered 800 Pcs.	Revised Quantity Pcs.	Date	Revised Quantity Pcs.	Date	
5	Pieces Required per Unit 2	Units Required 400		Govt. Insp. Required	Navy	Army	None ✓
6	Kind of Material S.A.E. 3140	Pattern Number		Forging Number		
7	Size of Bar Material 9" Diam.	Shape Round		Total Feet Required 106.333		
8	Length required to make 1 pc. = 1.200 inches; plus 1/4" width of cut-off tool = 1.450 inches;					
9	multiplied by (800 pcs. plus 10% for contingencies) 880 pcs. = 1276" ÷ 12 = 106 1/3 feet.					
10	On castings and forgings allow 5% and on bar material 10% for contingencies.					

MATERIAL RECEIVED

	Date	Quan.	Bars	Feet-Inches	Lbs.	Lot No.	Date	Quan.	Bars	Feet-Inches	Lbs.	Lot No.
11	11/15/30		3	24-7	5330.7	1100						
12	11/20/30		7	56-4	12215.3	1100						
13	12/5/30		4	25-5	5511.5	1100						
14												
15	Total			105-16	23057.4							

Deliveries of 200 pieces a month required to commence Dec. 20, 1930

16	Number of Shipments	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	Status Required	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128
18	Balance Due	200	192	184	176	168	160	152	144	136	128	120	112	104	96	88	80
19	Number of Shipments	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
20	Status Required	136	144	152	160	168	176	184	192	200	208						
21	Balance Due	72	64	56	48	40	32	24	16	8	0						

	Date	Shipments				Total Month	Total Shipped	Balance Due	Excess	Shortage
22	Dec. 1930	20/5	25/30	29/10	31/10	55	55	745		1
23	Jan. 1931	10/100	20/100	29/50		250	305	495	50	
24	Feb. 1931	15/100				100	405	395		100
25	Mar. 1931	5/100	15/100	25/100		300	705	95	100	
26	Apr. 1931	15/100				100	805	0		
27										
28										
29										
30	Jan. 1931	15/10	80% completed. See our letter 1/15/31			Our invoice #2710 Our shipping memo #5708				
31	" "	27/5	85% " " " " 1/27/31			Our invoice #2850 Our shipping memo #5950				
32	" "	30/2	Their letter 1/30/31. Their shipping memo #1200			Our credit memo #2870 Their invoice #700. To be rejected				
33										

Form that Shows at Any Time the Progress Made in Filling a Customer's Order

On the 22nd of the month, three Sundays will have been included in the production period, so that there will have been only nineteen working days. Referring to the nineteenth working day, it will be noted that 152 pieces should have been completed. Thus, the Sundays that have elapsed must be deducted from the date on which the inspection is made in order to arrive at the actual number of working days that were available.

Lines 18 and 21 show the balance or number of pieces required to fill the order at the end of each successive working day. The balance of 200 pieces for the first working day is the difference between the total of 208 pieces and the 8 pieces produced on the first day, and is not to be confused with the 200 pieces required per month. Lines 22 to 33 are for recording shipments. Line 22, for December, shows that 5 pieces were shipped on the 20th, 30 pieces on the 25th, 10 pieces on the 29th, and 10 pieces on the 31st, resulting in a total for the month of 55 pieces, which leaves a balance of 745 pieces still on order. Since shipment was due to commence on December 20, reference to line 21 shows that on the 20th working day there was a balance of 48 pieces for the remainder of the month, so that the 55 pieces shipped appears to be 7 pieces in excess of schedule requirements.

We must keep in mind, however, the fact that line 19 shows working days and not days of the month; and while this line indicates that there are six working days from the twentieth to the twenty-sixth working day, we actually have available from eight to eleven days from the 20th to the last day of the month, depending on the number of days in the month concerned. However, there will be at least one Sunday within this period. For this reason, it is best to refer to the figure below 19 instead of below 20, to determine the number of pieces scheduled for delivery in December. Thus, we find that 56 pieces should have been delivered in December in order to meet the required schedule. Comparing this with the record of shipments on line 22, there appears to be a shortage of one piece for the month of December.

The record of shipments for the next month's schedule, shown in line 23, involves the entire month. Hence, the total number of pieces shipped that month should be compared with the schedule for a full month, or 200 pieces. Thus, in this case, the records show that shipments for January exceed by 50 pieces the number required per month. Line 24, however, shows that shipments for February fell short of the required quota by 100 pieces.

On the other hand, line 25 shows that in March the monthly schedule of 200 pieces was exceeded by 100 pieces. Line 26 shows the record that closes the order with a total of 805 pieces shipped. It does not need to show any excess or shortage, as the excess or shortage recorded pertains to each individual month. This permits the production efficiency for the different months to be compared easily.

In the event that material is furnished by a customer and there is occasion to return defective stock, a record can be made as shown in lines 30 and 31. The record would show the value of labor performed on the faulty material, with the percentage of the work completed. That percentage of the total price could then be invoiced, and should the customer question the amount of this invoice, the percentage figures are always available to substantiate the manufacturer's claims. Thus a mutually satisfactory adjustment can generally be made. If the customer returns any goods as rejected or for correction, this fact can be shown, as indicated on line 32, and the word "rejected" or "corrected" can be written in as the case requires, so that the records will be complete.

Industry Discovers the Value of Color

In an article entitled "When Industry Discovers Color," published in a recent number of *Review of Reviews*, T. J. Maloney, of the New Jersey Zinc Co., points out the growing tendency toward the use of color in machine shop interiors, including the painting of machines themselves in vivid hues. Quoting from the experience of one company, Mr. Maloney lists the benefits derived from the painting of the machines in colors other than black, as follows: (1) Elimination of eyestrain. Color contrasts the product against the machine and hence does not unduly tax the eyesight. (2) Elimination of fatigue and nervous tension. (3) Improved morale; better attitude toward work and better personal appearance. "No words," says the author, "can describe this most important benefit of color. The worker at his bench and the general brightness and cheer of the changed atmosphere must be seen to be understood." (4) Reduction of accident rate. (5) Better inspection; better and increased production. (6) Advertising value; the pioneers in plant color are having their color work and their product broadcast by all employes, visitors, and inquisitive editors.

There is no doubt that we have entered upon an age of color and that even industry's work-shops will gradually succumb to the new conception that color brings cheer and that cheer produces more and better work.

One large plant is now being built in which color has been given great prominence. The color scheme for walls, posts, and ceilings has been carefully studied, and the machines will also be painted in bright, yet restful, tints. Industry is committed to color and the next few years are likely to see many startling new departures.

Boring and Honing Seamless Steel Tubes

The Hydraulic Cylinders Produced by the Methods Described are so Accurate that Leakage Under High Pressures is Negligible

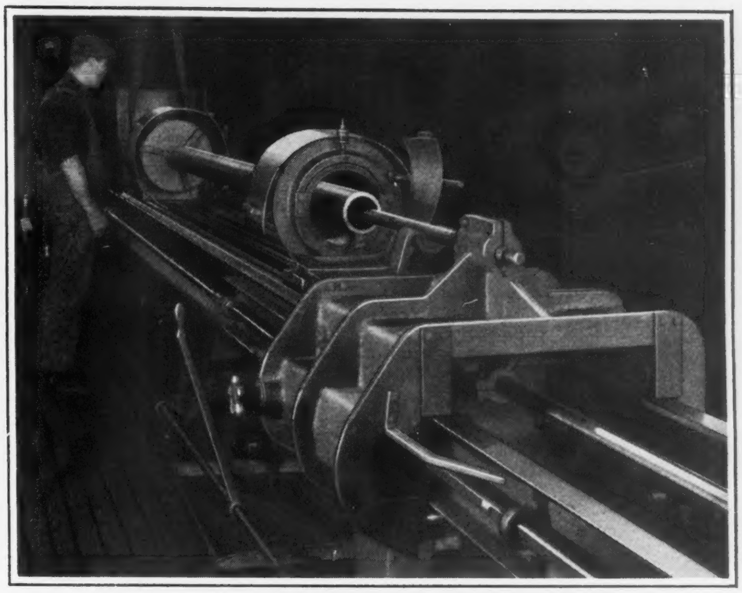


Fig. 1. Equipment Used in Honing Hydraulic Cylinders to Such an Accuracy that, with a Pressure of 1000 Pounds per Square Inch, the Oil Leakage between the Cylinder and Piston will not be Greater than from 0 to 4 Cubic Inches per Minute, Depending upon the Size

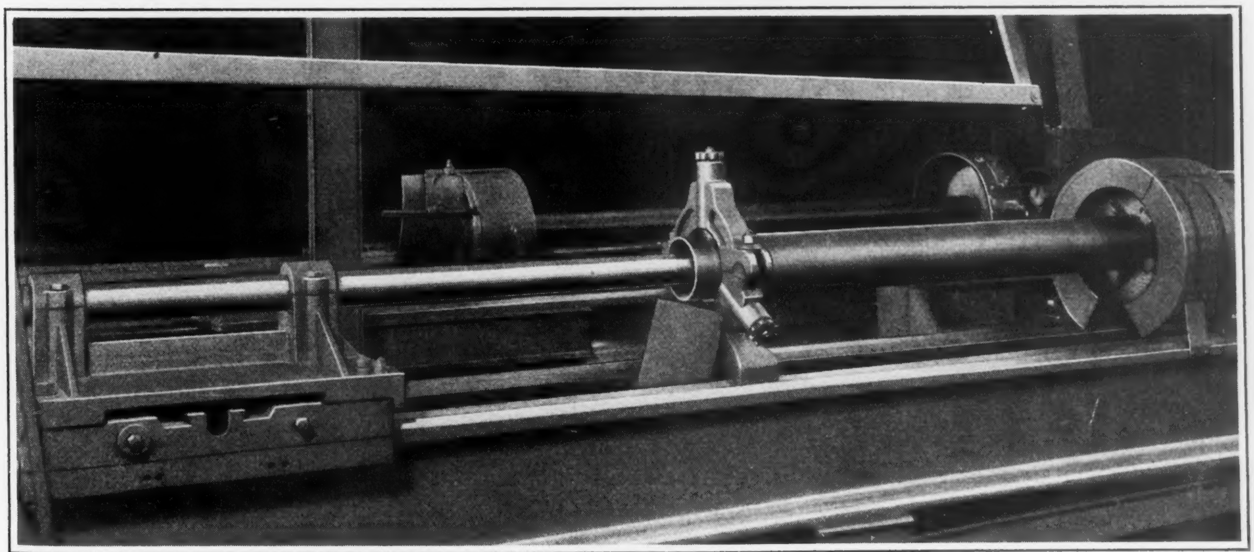
OIL leakage is an important factor in the efficiency of hydraulic systems used for the operation of machine tools, and obviously, it is desirable to hold leakage to a minimum. In the hydraulic equipment manufactured by the Oilgear Co., Milwaukee, Wis., the leakage permissible between pistons and cylinders with a pressure of 1000 pounds per square inch is held to from 0 to 4 cubic inches per minute, depending on the cylinder size. The cylinders are tested for leakage at both ends and in the middle.

Such a close control of the leakage requires cylinders and pistons possessing a high degree of accuracy. The cylinders are honed to size within 0.0005 inch, and similar accuracy is specified for parallelism and out-of-roundness. The pistons are made 0.006 inch smaller in diameter than their cylinders and are equipped with four rings.

Seamless steel tubing of standard thicknesses is used in sizes of from 1 1/2 to 7 1/8 inches for the cylinders. The average length of the cylinders is 3 feet, but many are as long as 15 feet. In the illustrations, the cylinder shown is 64 inches long, 6 inches inside diameter, and 6 5/8 inches outside diameter.

The first step in finishing the inside of the cylinders is to bore them to the approximate size with equipment such as shown in Figs. 2 and 3. Use is made of a cylindrical cutter-head that guides itself on the surface finished by an inserted high-speed steel blade. This blade is ground to a radius on top directly in back of the cutting edge, and it is ground to an angle along the front for clearance. The blade

Fig. 2. Method of Boring the Seamless Steel Tubing that is Used for Hydraulic Cylinders in Machine Tool Installations



is relieved at the end that starts the cutting, so that the cut increases gradually in depth as the blade enters the tube. A copious supply of coolant is fed to the cutter through the center of the boring-bar and a small piece of tubing soldered to the outside of the cutter-head.

How the Tubes are Held Accurately for Boring

The boring-bar to which the cutter-head is attached is 4 inches in diameter and is mounted in two substantial bearings on the special carriage with which the lathe is provided. At one end the work is gripped in a four-jaw chuck, while at the opposite end it is supported by a steadyrest. The custom is to turn the ends of long tubes for a short distance, so as to insure accurate centering of the work in the machine. In setting up the work, before the steadyrest rollers are adjusted on the tube, the tube is aligned through the use of a cone-shaped plug attached to the spindle of the headstock.

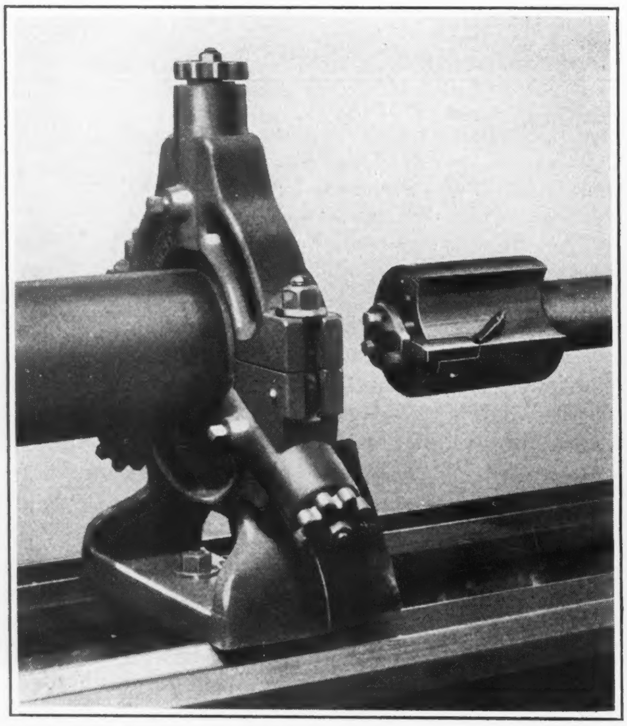


Fig. 3. Design of the Cutter-head Employed for Boring Seamless Steel Tubing

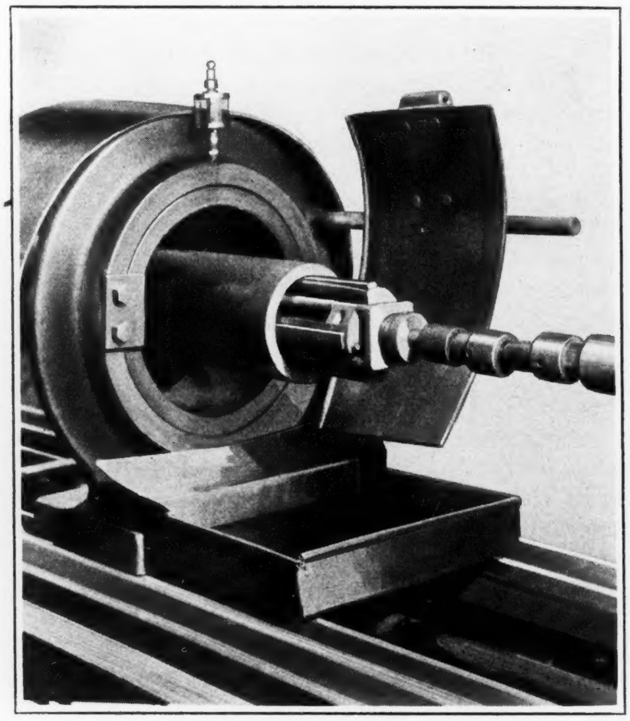


Fig. 4. Construction of Hone and Steadyrest that Supports Outer End of Cylinder

On some cylinders, only one boring cut is required, but on others, roughing and finishing cuts are taken. When the material is unusually tough, the tool tends to wear so rapidly that the hole tapers as much as 0.004 inch from the front to the back. This must be guarded against as far as possible. To provide for this, the practice has been adopted of boring to a diameter that will leave approximately 0.004 inch of stock for honing.

A feed of about 1/2 inch per minute is employed for tubes of the size illustrated, and about 1 inch per minute for smaller sizes. The boring-bar carriage has a slide that is adjustable laterally for controlling the depth of cut. This varies with different cylinder sizes; for the 6-inch size illustrated, about 1/8 to 1/4 inch of stock is removed on each side.

Honing to Obtain a Mirrorlike Finish

The cylinders are honed in the lathe illustrated in Fig. 1, which is provided with a special carriage that is reciprocated by Oilgear hydraulic means. A spring-type hone is mounted on the front end of a sturdy bar attached to this carriage. A universal connection is provided for the hone, as illustrated in Fig. 4, so that it can follow the bore produced in the preceding operation. The hone is set to approximately the prescribed cylinder diameter at the beginning of the operation and expands automatically to this setting as the cylinder bore is honed away. There is a support for the hone bar directly in front of the steadyrest. Attention is called to the steadyrest construction, which can be clearly seen in Fig. 4.

During the honing, the work is revolved at 80 revolutions per minute and the hone is traversed at the rate of approximately 90 feet per minute. The length of hone traverse is governed by means of stops which operate an Oilgear combination valve when the carriage reaches the extreme points of its stroke. Kerosene is used as a lubricant between the hone and the cylinder. Measurements are taken at intervals by means of internal micrometers to determine the size of the cylinder at different points along its length.

To provide for the special carriage, it was necessary to lengthen the lathe bed through the use of channel irons, which may be seen in the foreground of Fig. 1. Rollers attached to the carriage run on the top and bottom legs of these channel irons to provide easy movement of the carriage. One man runs this honing machine in conjunction with two boring machines.

Details of the Hydraulic Equipment

The high degree of finish obtained in honing the cylinders is attributed by the concern in a large measure to the fact that the hone is reciprocated hydraulically. The cylinder and piston that operate the hone carriage are located between the bed ways directly in the center of the machine. The cylinder is of the 2 to 1 differential type and is used in combination with a three-way circuit that provides equal carriage speeds in both directions.

The pump, which is located at the headstock end of the machine, is of the constant-pressure variable-delivery type manufactured by the concern. It has a capacity of 3060 cubic inches of oil per minute. The running speed is 860 revolutions per minute. This pump is a one-way design which delivers oil in one direction only, the combination valve previously referred to controlling the flow of oil to the opposite sides of the piston. In addition to traversing the hone rapidly during an operation, the hydraulic equipment may be employed for "inching" the hone in setting up the job.

Making 400 Welded Jigs a Month

The Westinghouse Electric & Mfg. Co. has found that the time required for making jigs and fixtures can be considerably shortened by the use of arc welding, a process that the company has been using with satisfactory results for several years past. A very thorough investigation as to the reliability and the accuracy of arc-welded construction was carried on by the company before a decision was reached to use it extensively for jigs. Several jigs and fixtures were fabricated and tested for inaccuracies, such as warpage, distortion, vibration, etc. This testing has been carried on for several years, by periodically checking the fixtures constructed. Complete details will be published in October MACHINERY.

* * *

The Work of Design Engineers

In a paper entitled "The Selection of Design Engineers," read before the Machine Design Division of the Society for the Promotion of Engineering Education at a meeting held recently at Purdue University, Edwin H. Brown, who has had a long engineering experience with the Allis-Chalmers Mfg. Co. and the A. O. Smith Corporation, both of Milwaukee, Wis., divided the work of design engineers into three parts: (1) Apparatus design; (2) plant design; (3) design analysis.

Apparatus design is considered as covering the field of machine design and kinematics, heat transfer apparatus, and machines and apparatus that have to do with the flow of fluids, both liquid and gaseous. Engineers engaged in apparatus design work in or directly supervise a drawing-room where designs are made for manufacturing.

Plant design includes all the important work of shop and plant arrangement and has as its essential function the coordination of the work of apparatus designers with that of the plant operators or the production staff. It also covers the field of the mechanical engineer's work in the structural design of buildings.

The term "design analysis" is applied to the work which has become of great importance to the general administration of industries engaged in the manufacture and fabrication of engineering apparatus. Design analysis covers the mathematical application of the laws of thermodynamics, hydraulics, and the flow of fluids; stress determinations; vibration effects, etc. It frequently has placed on it the burden of determining whether a proposed machine or a process of manufacture or operation that is in accord with scientific laws is practical as a commercial proposition. The work of design analysis is considered also, in some of its phases, as related to the functions of engineering economics.

The man with ingenuity—the man having the faculty of devising ingenious mechanisms or motions, especially if he also possesses patience and persistence, is most successful as an apparatus designer.

The plant designer, because of the need for coordinated effort, finds an attractive personality and good memory valuable qualities. The ability to summarize concisely and observe closely are valuable characteristics of successful designers in this class of work.

Design analysis requires men having a reasonable command of applied mathematical laws and who are able to do original and analytical thinking. They must also give studious attention to that which has been published in the past on the subject under consideration.

The American engineering schools are more likely to fit men for design analysis than for apparatus and plant design. It would be of great value in the field of apparatus design if more academic training could be given in the limitations that are imposed by manufacturing processes in steel mills, pattern shops, foundries, machine shops, and assembly plants. There is an aversion on the part of the American engineering student to work in the drafting-room. This aversion might be removed and his excellent training in other phases of engineering made available for apparatus design if his training before entering industry gave him the proper perspective in this regard.

Here is a real problem for the engineering schools and an opportunity to perform a service both to the young engineer and to industry.

Square Shells Trimmed in One Stroke

By CHARLES M. BREHM, Engineer
The Steel Products Engineering Co.
Springfield, Ohio

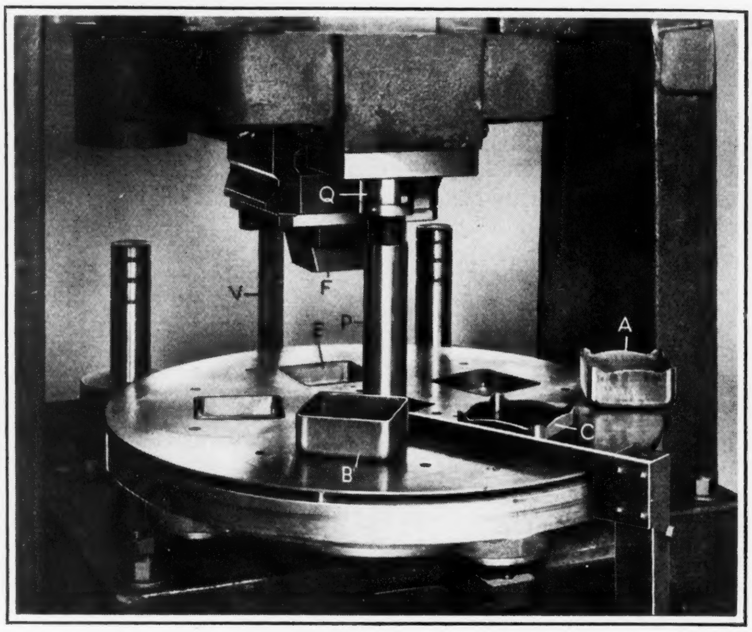


Fig. 1. Equipment Used in Trimming Shells Such as Shown at A along All Four Sides at the Rate of Twenty-five per Minute

TWENTY-FIVE shells of the shape illustrated at *A* in Fig. 1 are trimmed per minute along all four edges in a single operation performed in an arch-type power press. This machine operates continuously and is equipped with a five-station dial feed, as shown, which carries the shells automatically into position beneath the ram and then to the ejecting point. A Brehm trimming die attached to the ram oscillates in four directions in a horizontal plane during the downward stroke, shearing off all excess stock at one stroke of the ram. At *B* may be seen one of the trimmed shells. They are drawn from 0.078-inch steel sheets and are 4 inches square, with a trimmed height of 1 1/2 inches. Both the dial feed and the trimming die were made by the Steel Products Engineering Co.

The shells are placed by hand in the dial cavities at station *C*, Fig. 1, being seated on a block *D*, Fig. 4. This block rides on top of a plate until it has been indexed into position *E*, Fig. 1. Here it is held in a raised position in the cavity by means of a spring buffer arrangement, so that the gage-block *F*, Fig. 4, can enter the shell at the down stroke of the press ram. The gage-block supports the shell on the inside during the trimming operation and locates it accurately at the trimming height.

The spring buffer holds the shell firmly against the bottom of gage-block *F*. This block is attached to the face of the trimming die *G* in such a manner that the block remains stationary in the work while the trimming is being done, although die *G* is oscillated horizontally.

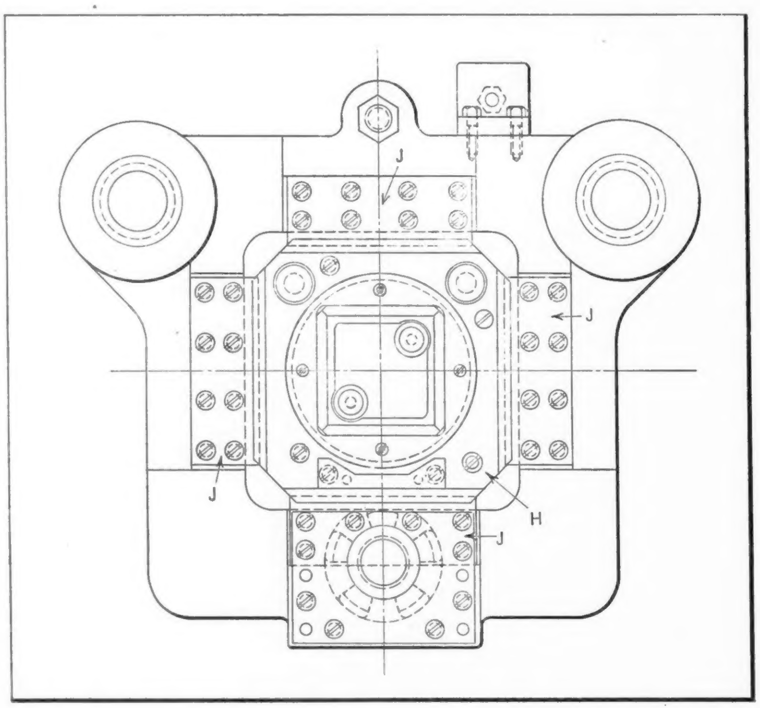


Fig. 2. Arrangement of the Cam Box and Blocks that Operate the Trimming Die to the Front, Back, Right, and Left for Trimming in One Horizontal Plane

How the Trimming is Done

Trimming die *G* is attached to a square box *H*, which is provided on all four sides, as illustrated in Fig. 4, with cam surfaces that are engaged by four blocks *J*. When the ram moves downward, the entire die unit moves with it, gage-block *F* pressing the shell

and block D down on the spring buffer until stops K come in contact with plate L. Then the trimming die unit is prevented from moving any lower, and as die-holder M continues downward with the ram, blocks J cause cam box H and die G to move consecutively toward the front, back, right, and left for trimming the four sides of the work. Obviously, the right and left movements of the die do not occur until after blocks J reach points x on the cam box. The downward movement of the ram after die G reaches the trimming position is approximately 3 3/16 inches. The horizontal movement of the die in each direction is about 3/16 inch.

On the up stroke of the press ram, as the cam surfaces on box H pass blocks J, the trimming die unit goes through motions that are the reverse of those just described. The three plugs K and the springs around studs N insure that the face of the trimming die will be held firmly in a horizontal plane during the trimming.

The Trimmed Shells are Automatically Ejected

When the trimmed shell is indexed from beneath the die and moves toward the front of the dial, block D is raised gradually by cam O until it is flush with the top of the dial. Then, as the finished shell strikes the bar seen at the front of the machine in Fig. 1, it is easily guided from the machine into a convenient receptacle. Cam O is of a circular construction, as may be seen from Fig. 3.

Means Employed for Indexing the Dial Feed

At the center of the dial feed there is a cylindrical bar P, Fig. 4, fitted at the upper end with a part Q having splined teeth that engage similar teeth on block R. When the press ram and the trimming die unit move upward, the teeth on part Q engage those on block R and prevent bar P from revolving. This causes the two rollers S, fastened to the lower end of the bar, to be moved along cam grooves in a sleeve T which is doweled to the feeding dial. The result is that the dial is revolved in a horizontal plane an amount corresponding to the lead of the cam groove, or 72 degrees.

Brake U operates against the edge of the dial to stop the indexing as each die cavity reaches the trimming position. This braking action is essential because of the momentum produced by the high-speed operation of the equipment. Brake-shoe U engages the edge of the dial as rod Y completes its upward movement with the press ram. Conversely, the brake is disengaged as the rod moves downward with the ram.

On the downward stroke of the press ram, parts Q and R are disengaged, allowing bar P to rotate sleeve T without causing any movement of the dial.

Operation of the Dial Locking Mechanism

Accurate locking of the dial when each cavity comes beneath the trimming die is effected through plug Z, Fig. 5, which enters bushings in the dial.

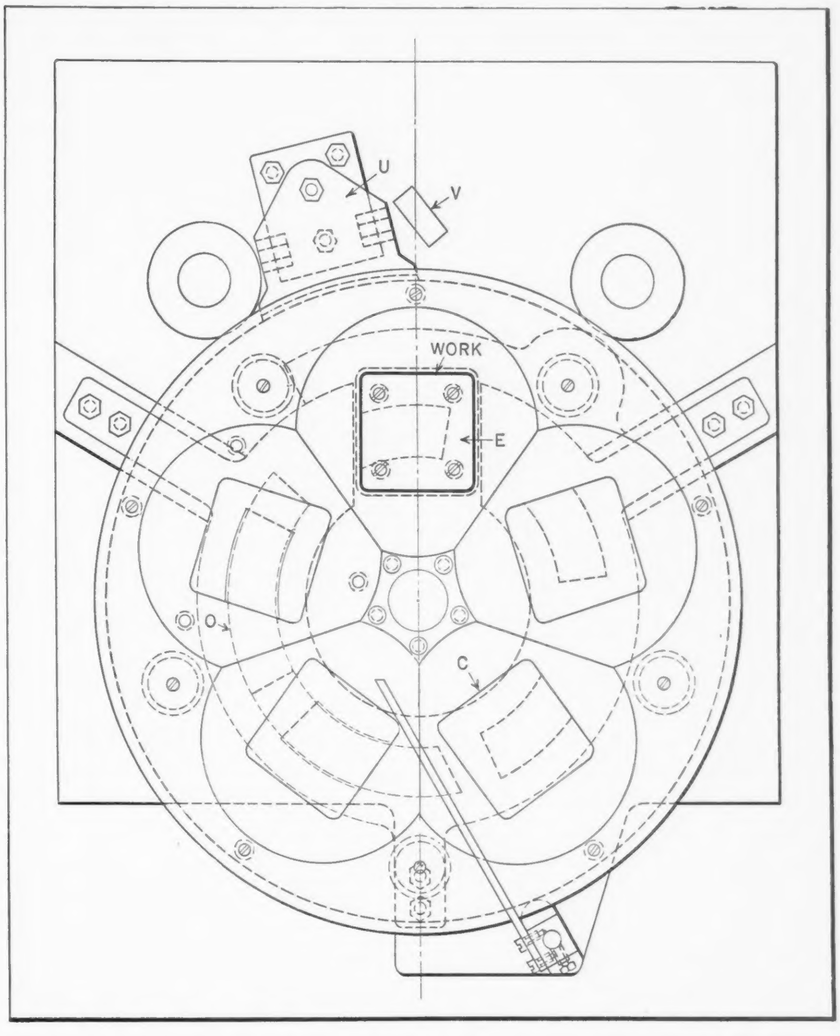


Fig. 3. Plan View of the Dial Feed which Carries the Untrimmed Shells Automatically to the Trimming Die and Then Ejects the Finished Work

When rod V, Fig. 4, descends with the press ram, it pushes roller X in the same direction until the roller rides on the wide cam surface at the lower end of rod V. At the end of the down stroke, the roller is in the position seen in Fig. 5, being above the cam surface of the rod. Pin Z remains in the locking position during the downward or cutting stroke of the press.

On the return stroke of the press ram, the cam surface of rod V pulls roller X upward and imparts a swiveling motion to lever W. This withdraws

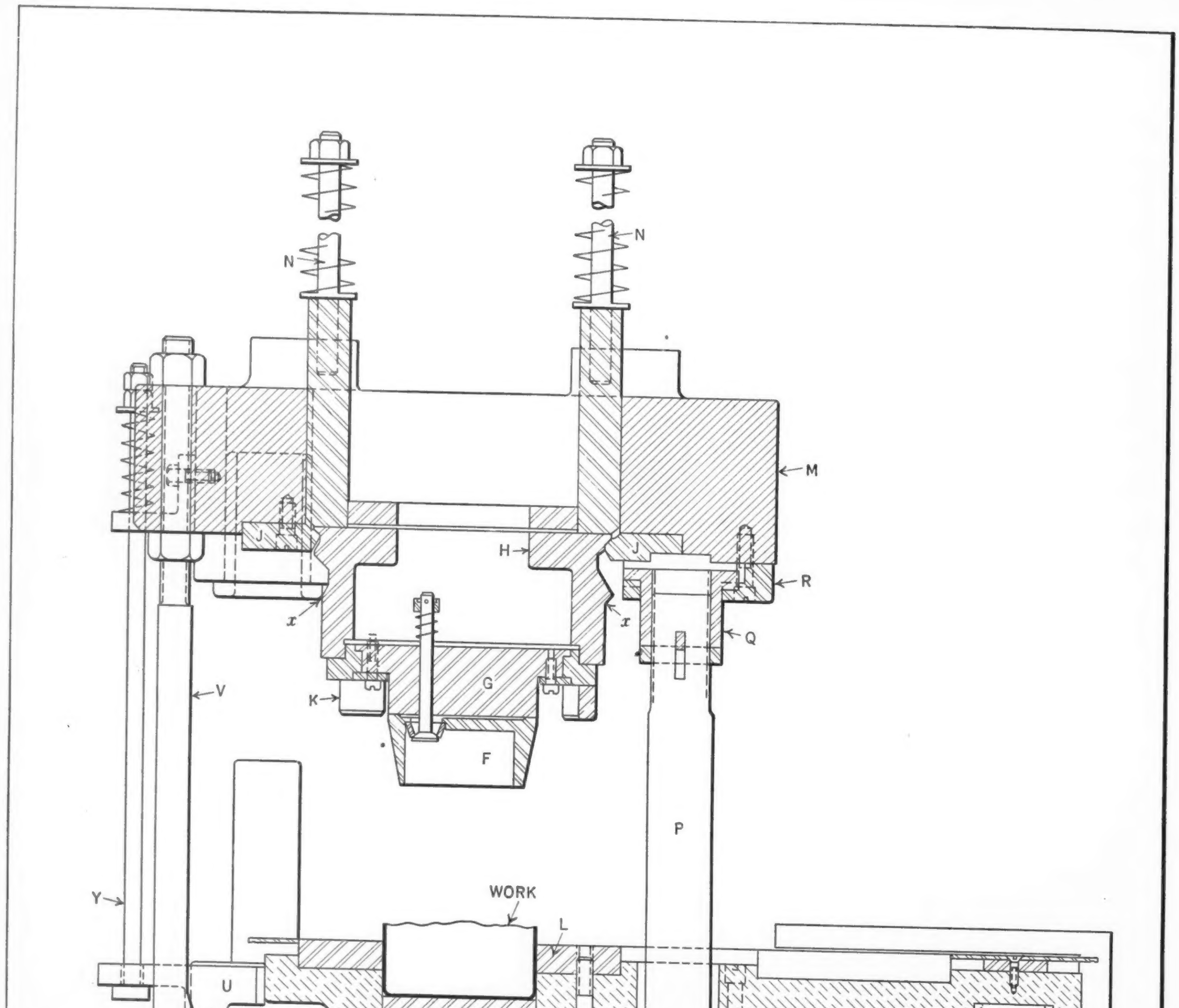


Fig. 4. Sectional View Illustrating the Means Employed for Actuating the Trimming Die

pin *Z* from the dial bushing and the pin is kept withdrawn until the dial has indexed. When roller *X* has cleared the end of the rod *V*, pin *Z* is again forced upward into the locking position by springs.

An important feature of the mechanism is that the machine is automatically tripped for the next down stroke of the ram each time that the locking pin enters a bushing in the dial. This automatic tripping is effected through the link connected to lever *W*. Unless the dial is locked by means of pin *Z*, the press cannot be tripped, either automatically or by the operator.

The dial is made of Duralumin and may be fitted with hardened steel inserts of various shapes to suit the particular work to be handled.

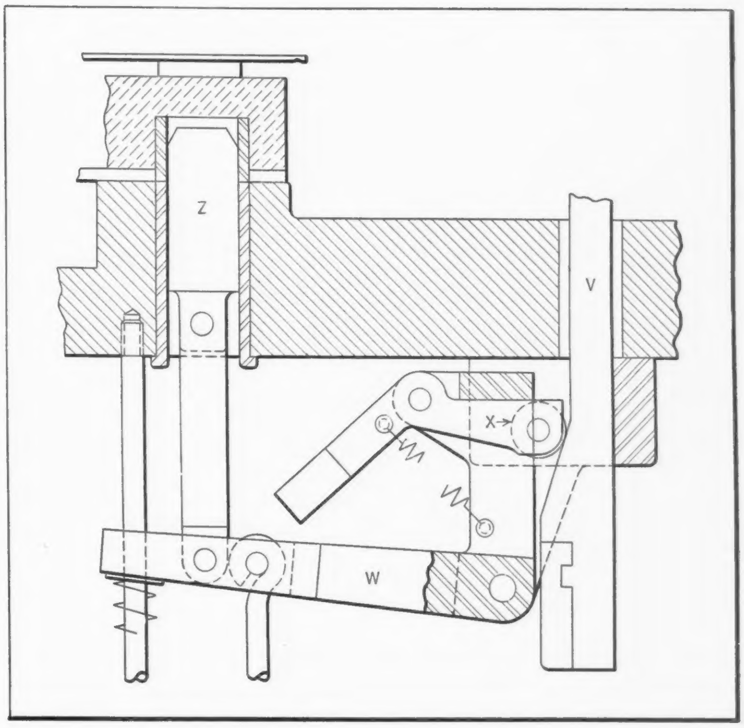


Fig. 5. Mechanism Employed for Locking the Dial Feed as Each Cavity is Indexed Beneath the Trimming Die

* * *

Indicating Finish

By F. E. FICK

The writer noticed the articles on indicating finish in May MACHINERY, page 690, and in July MACHINERY, page 855, and desires to contribute to the discussion by describing the practice in some of the large drafting-rooms in which he has worked during the last twenty-six years.

In the words of a leading automobile engineer, "Drawings are made to convey information, and to convey complete information—not to test the guessing ability of some mechanic." The writer tries to keep this idea in mind in making a drawing, and accordingly, does not approve of using the symbols "f" to indicate rough machine finish, "ff" to indicate smooth machine finish, "gf" to indicate ground finish, and "pf" to indicate polished finish, as described in the last paragraph of the article in May MACHINERY.

These terms are not in general use and are likely to prove confusing to the mechanic. When any finish other than an ordinary machine finish is required, the word describing the type of finish should be printed on the drawing adjacent to the surface to be finished, as for example, "smooth finish," "file finish," "gasket finish," "grind," "lap," etc. This relieves the mechanic of any guessing as to the finish the designer intended the part to have.

Another point that should be emphasized more strongly is the necessity or desirability of indicating the amount to leave for finishing. This concerns the patternmaker and is important information. Sometimes it is desirable to leave only 1/32 or even less for finishing, so that the required surface can be produced by disk grinding; again, an allowance of 1/16 inch for machining is sufficient to obtain the desired finish; in some cases, 1/8 inch or more is required on large castings or when an extra clean surface is desired for valve seats, surface plates, machine ways, etc.

It was the practice in one large drafting-room where the writer worked to specify the amount required for finishing by placing a small figure after and below the "f" mark. A note printed on the drawing sheets explains the system as follows: "On all castings allow finish as follows: $f_1 = 1/32$; $f_2 = 1/16$; $f_3 = 3/32$; $f_4 = 1/8$, etc." This relieves the patternmaker of the responsibility for determining the amount to leave for finishing, and places it on the designer, where it belongs, especially when the patterns are made by some outside pattern shop. In such cases, the patternmaker is not familiar with the functions of the piece for which he is making the pattern, and must therefore set the allowance for finishing by guess.

* * *

Machine Design Committee Appointed

A committee on machine design has been formed under the auspices of the American Society of Mechanical Engineers. The committee, which has been appointed by F. C. Spencer, chairman of the Machine Shop Practice Division of the Society, will arrange for papers on machine design to be presented at meetings of the Society, and will, in general, coordinate the activities of members interested in the design phase of engineering and manufacturing. Frank L. Eidmann, professor of mechanical engineering at Columbia University, is chairman of the new committee, the work of which promises to create much interest among designing engineers.

Notes and Comment on Engineering Topics

Strange as it may seem, "dry ice" is performing an important function in the building of airplanes; it is employed by the Boeing Airplane Co., Seattle, Wash., to prevent Duralumin rivets from becoming too hard for use after heat-treatment. The rivets are stored in boxes in which dry ice is placed immediately after heat-treatment. The low temperature prevents the rivets from hardening and they can be taken from the boxes in a workable condition. Approximately 100 pounds of dry ice are used weekly for this purpose at the Boeing plant.

Danger of overheated brakes and tires on motor cars and trucks is reduced to a minimum by a novel new "air blast" brake-drum. Radial ribs or fins cast to the inside back face of the brake-drum are covered with a thin plate, forming a centrifugal fan that draws in cool air through small holes at its smallest diameter and blows it between the drum and lining, over the shoes and on the tires. The Gunite Corporation, Rockford, Ill., manufacturer of the new brake-drum, claims that this method of cooling the brake parts at the hottest points, rather than on the outside of the drum, materially improves braking performance and also protects the tires against overheating.

New England is to have a new kind of electric generating plant—a floating one that can be towed to some section that may be in need of additional power. A very large part of the energy required by the subsidiaries of the New England Public Service Co. is supplied by water power; but it is necessary to have a certain amount of steam auxiliary power to furnish service in times of decreased water supply. By installing this steam-generating equipment on shipboard, reserve capacity may be made available at any one of several points along the New England coast. The floating power station will be in operation during a greater part of the time than a stationary stand-by plant would be; hence, the new departure should prove decidedly economical. The boat on which the generating equipment is to be installed was originally a cargo vessel of 7000 tons, 380 feet long, and 50 feet wide. The capacity of this floating power plant will be 20,000 kilowatts. Power will be produced by two General Electric turbine generators.

Users of moving picture equipment who make industrial pictures or pictures of machine operations or manufacturing processes will be interested in the announcement of a new film that has been brought out by the Eastman Kodak Co., Rochester, N. Y. This film is extremely sensitive to light of all colors, and has the advantage that much less light than was formerly required for ordinary films is needed to make brilliant pictures. In fact, pictures can be taken by the use of ordinary electric light. With the new film, movies can easily be made after dark on brightly lighted streets, and animated electric signs, artificially lighted window displays, and floodlighted buildings can all be successfully photographed. This film is known as a supersensitive panchromatic film, and is applicable to 16-millimeter movie cameras.

An 11-foot gyro-stabilizer weighing 120 tons, which was designed to prevent the rolling of ships, was recently tested at the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. The huge "top," which, alone, weighs 110,000 pounds, spins at a speed of 930 revolutions per minute within the stabilizer casing. A built-in 200-horsepower motor furnishes the motive power. It is stated that this gyro will keep a large ship—say 450 feet long—within two degrees maximum roll. Almost an hour is required to get the 55-ton rotor up to its full speed, and when the power is cut off, the rotor will revolve, due to its own momentum, for more than two hours. This stabilizer is one of the largest ever constructed. It was built to the order of the Sperry Gyroscope Co. of New York for a foreign shipbuilder.

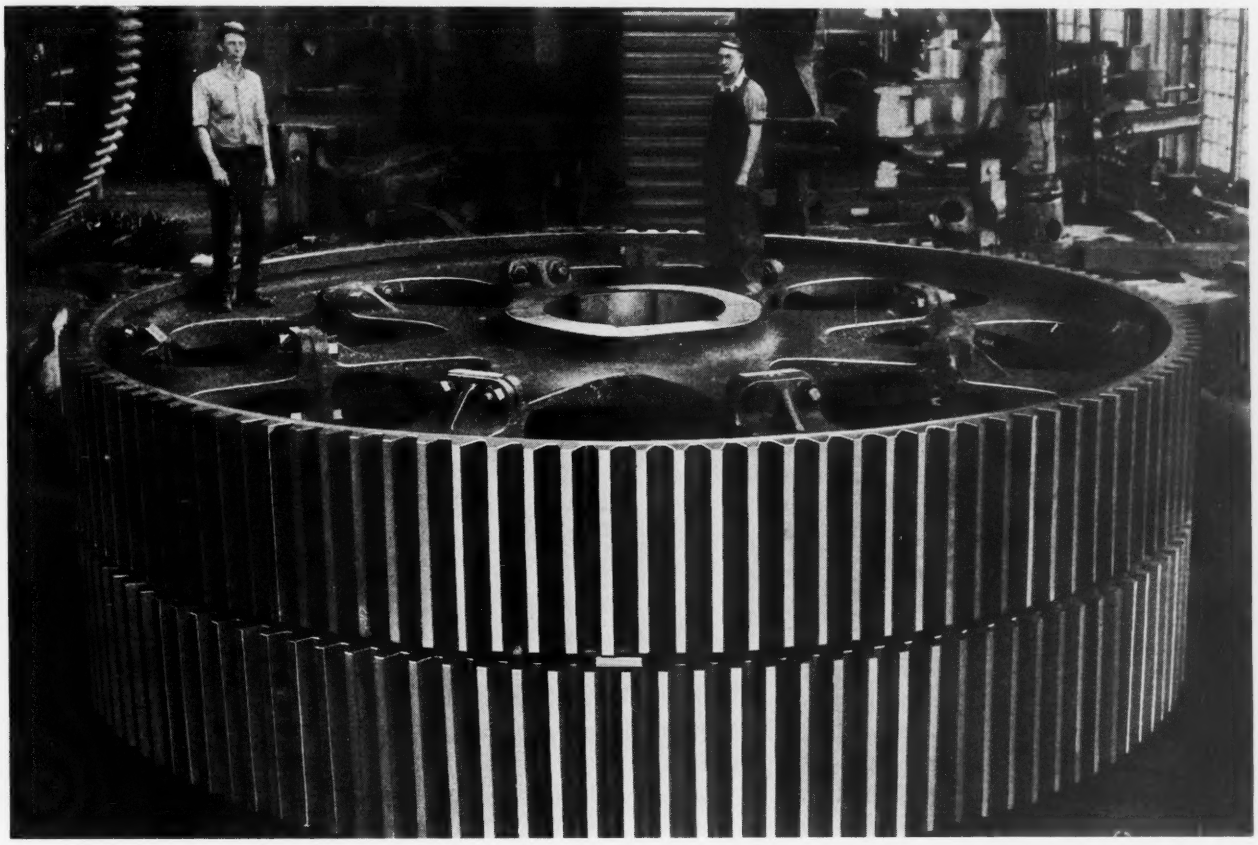
At a recent meeting of the Society of Automotive Engineers, the effect of color in changing the apparent size of automobiles was pointed out. The question had been raised, "What will color do to make automobiles seem longer and lower?" Six cars were experimented upon. In the case of three of them efforts were made to make them look as long and low as possible. To do so the roof, rear part, fenders, and wheels were painted dark, while a lighter color was applied through the center. Then the three that were to be made to look high had the roof, rear part, and upper panels painted light, with the body black and the fenders and wheels light.

When representatives of the firm that built the cars saw them, they believed that the sedan which had been painted to look long and low was actually, through some mistake, a longer and lower car than the other sedan. By actual measurements, it was determined that the low-looking sedan was really

one-half inch higher than the other, because the tires on it were fully inflated, while the tires on the car that seemed higher were under-inflated. Color can be used to greatly assist in obtaining the effect in appearance that the designer desires in a machine or object.

Rigid conduit, the smaller sizes of which can be bent across the knee without tools, is the latest improvement in wiring construction materials announced by the Bridgeport, Conn., plant of the General Electric Co. The easy bending quality of this rigid conduit is the result of the development of a new kind of flexible alloy steel. The flexibility of the conduit assures freedom from breaks. The new conduit can also be threaded more easily than materials formerly used, giving a practically perfect, clean-cut, firm-holding thread.

In the application of Diesel engines for marine propulsion purposes, the great weight of these engines has often been considered a disadvantage. In some cases the weight has been the deciding factor in determining whether Diesel engines should be employed for ship propulsion in preference to other engines. It is, therefore, of interest to note that, according to *Engineering*, a system of construction has been patented by C. H. Stevens of the Steel Barrel Co., Ltd.. Uxbridge, England, which has been adopted in recent designs of marine Diesel engines. In this method of construction, the frames are made from steel sections welded together electrically. It is stated that the engine weight has been reduced 45 per cent per horsepower, as compared with previous designs in which castings were used entirely.



A Gear Having a Pitch Diameter of 21 Feet 4 Inches with a 6-foot Face, Weighing about 138 Tons. The Gear was made by the United Engineering & Foundry Co. and is Built Up from One Center Spider Carrying Two Rims Consisting of Four Segments Each. The Gear is Constructed from Steel Castings

The installation of a mercury-vapor boiler and turbine-generator at the power plant of the Hartford Electric Light Co. some years ago has proved so successful that a 20,000-kilowatt mercury-vapor turbine-generator is to be installed in a new plant to be built in Schenectady, N. Y. The efficiency of the new plant will be greater than that of the Hartford installation, which, in itself, is very much more efficient than ordinary steam generating stations. The mercury required in the boiler will amount to 250,000 pounds. On account of the high specific gravity of mercury, however, this volume occupies less space than that contained in a cube with a seven-foot side. The first mercury-vapor installation in the world was that erected in Hartford, Conn., in 1923. The records of this installation show a substantial saving in fuel over ordinary steam power stations.

EDITORIAL COMMENT

It Pays to Cultivate The Salesmen Calling On Your Firm

The man that buys for a company—whether he be called purchasing agent or not—has a great opportunity to create good will for his concern. If the buyer treats the salesmen who call upon him with courtesy and consideration, he creates a favorable impression that may have a widespread influence. Men who sell come in contact with a large circle, and have an opportunity to affect the opinions of many people. Suppose that the hundreds of salesmen who call upon the average firm throughout the year should go about the country praising the firm where they have been well received and boosting its products. What a valuable form of advertising would be obtained at the price merely of ordinary courtesy!

A successful machinery salesman told us recently that he left a plant where he was received with consideration and courtesy, even though he had sold nothing, with a kindlier and more respectful feeling than he sometimes had toward a plant where he had received a good-sized order from a grouchy buyer.

The man who buys for his company can materially further its success by a consistent application of business courtesy.

Are Modern Tools Profitable in Boom Times Only?

Every plant manager in the United States doubtless believes, theoretically at least, in replacing tool equipment that is obsolete. But opinions differ decidedly about the meaning of the term "obsolete," and some doubt the advisability of installing modern equipment in the face of an abnormally low demand for nearly all manufactured products.

Will it pay under present conditions to scrap an obsolete machine, or should such replacements be confined to boom times only? This general question is now being considered carefully, because as one manufacturer points out, "Mr. Demand will return, but he won't come back with a brass band. * * * He will steal up to the door of American business and ask for quick action."

Does it ever pay to use "cost-increasing" equipment? Numerous theories have been advanced, formulas deduced, and various attempts made to establish some standard method of determining when shop equipment should be replaced. A safe rule to follow is to buy the latest developments whenever it costs money not to buy. A machine may be in A-1 condition mechanically, but have an *economic value* that is too low. It may be comparatively new as far as age is concerned, but be old as a producer.

The justifiable investment in a machine will depend on its value-creating capacity, because every manufacturer's job is to increase the value of raw materials by changing them into some usable, saleable form. Father Time may decide whether the manufacturing processes are profitable or not. If they are unnecessarily slow, which is another way of saying that values are created too slowly, it will pay to investigate carefully the very latest equipment.

The inefficient machine or tool is bad for the employer, the employe, and the consuming public. Wasteful manufacturing practice may be ignored in boom times because profits can be made in spite of it, but under present conditions, any equipment that can lower net costs may not only be desirable but essential. Economy in production does not necessarily lead to over-production. Economy is a question of good equipment properly applied; production, in turn, must be controlled to suit the demand.

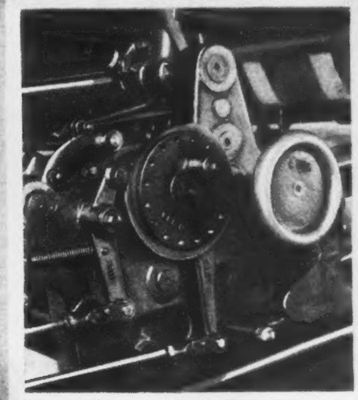
The Manufacture of Side Lines May Not Always Pay

In times like these many manufacturers are looking about for some product to make other than their regular line. They feel that while there is no demand for their own specialized product, it might be possible to keep the shop at least partially busy by making something else for which the demand may be greater.

In a few instances, manufacturers engaged in one line of business have been successful in taking on a new product, foreign to their principal endeavors; but in a great many more instances, the attempt has proved a costly experiment. The demand for the new product has not proved to be so great as was expected, entirely new selling problems have been encountered, and a competition keener than anticipated has had to be met.

Generally, it is not wise to introduce a new product into a plant making a specialized line of machinery or tools unless the conditions, upon very careful consideration, appear to be unusually favorable as regards manufacturing requirements, demand for the product, and sales outlets. And even then—watch your step.

Ingenious Mechanical Movements

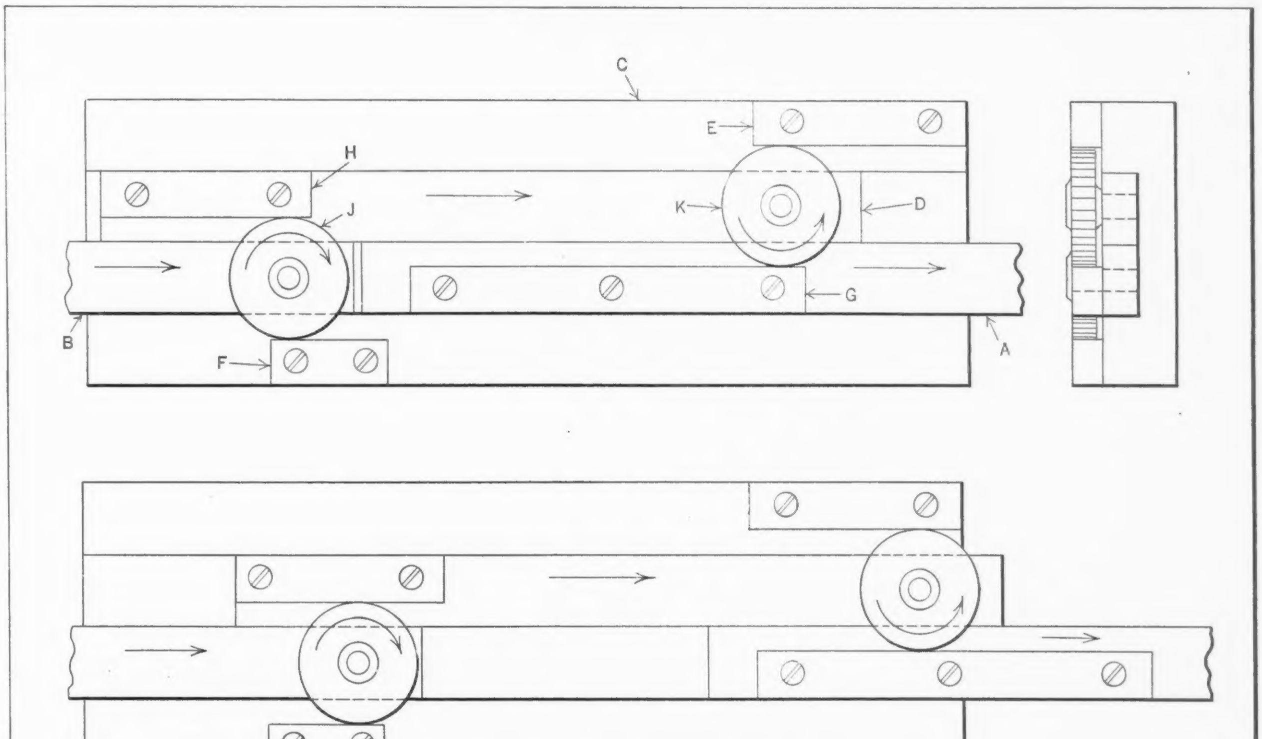


Mechanism for Quadrupling the Travel of a Slide

By R. H. KASPER

In the mechanism illustrated, the reciprocating slide *A* has a stroke four times as long as the slide *B* from which it receives its motion. This is effected through a series of racks and pinions, the pinions moving in a straight line and meshing with two opposite racks, one of which is fixed and the other free to slide. Obviously, the rack that is free to slide will move twice as far as the center of the pinion. This design is advantageous when a compact arrangement is required, and by using more than two gear combinations, the stroke imparted by slide *B* can be increased to any length.

The mechanism is mounted on the stationary block *C*, which is grooved to receive the three reciprocating slides *A*, *B*, and *D*. On each of the slides *A* and *D* is secured a rack, as indicated at *G* and *H*. Two stationary racks *E* and *F* are fastened to block *C*. On the ends of the slides *B* and *D* are the pinions *J* and *K*, each of which meshes with a fixed and a sliding rack. Full lines are used to represent the pitch lines of the gears and racks.



Rack and Gear Mechanism for Increasing the Stroke Imparted by a Slide to Four Times its Original Travel

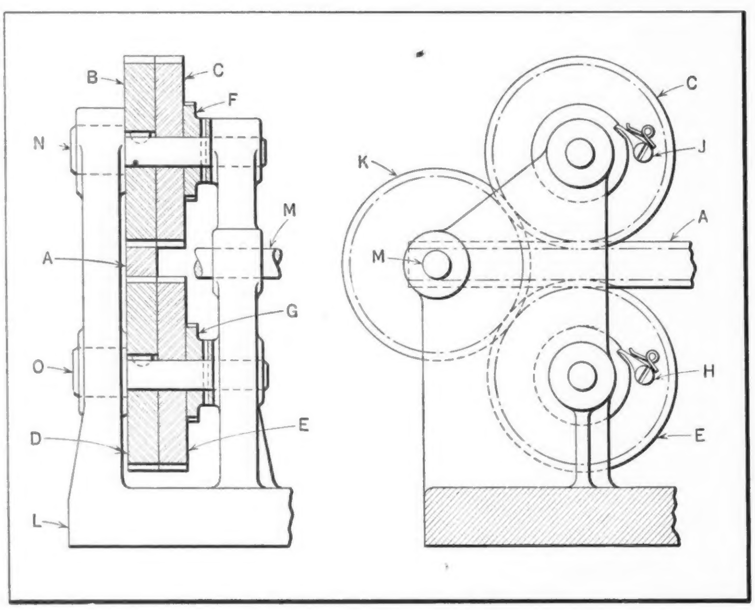
Now it will be seen that if slide *B* is advanced toward the right, say 1 inch, slide *D* will move 2 inches in the same direction through the action of pinion *J* meshing with the racks *F* and *H*. The same combination of gearing exists at the right-hand end of the block. Consequently, if slide *D* moves 2 inches, the stroke imparted to slide *A* will be 4 inches. At the end of this 4-inch stroke, slide *A* will be in the position shown in the lower view.

* * *

Rectilinear Movement Converted to Intermittent Rotary Movement

By RAYMOND O. KRENGEL

By means of the mechanism shown in the illustration, the reciprocating rack *A* imparts an intermittent rotary movement in one direction to the shaft *M* through the gears *B, D, C, E*, and *K*, and the ratchet wheels *F* and *G*. During each stroke of the rack, shaft *M* rotates one-half of a revolution and then dwells. The length of this dwell, as well as the velocity of shaft *M*, is controlled by automatic valves on an air cylinder (not shown) which actuate the rack.



Train of Gears Operated by a Rack for Imparting an Intermittent Motion in One Direction to Shaft M

Teeth cut in opposite sides of the rack engage gears *B* and *D*, keyed to shafts *N* and *O*, respectively. Gears *C* and *E* are free to turn on their shafts and mesh with gear *K* keyed to shaft *M*. Pawls, pivoted to gears *C* and *E*, engage ratchet wheels *F* and *G*, fixed to their shafts.

When rack *A* moves toward the left, gears *B* and *D* rotate in opposite directions, and pawl *J* simply rides over the ratchet teeth without imparting motion to gear *C*. Pawl *H*, however, engages ratchet wheel *G* and causes gear *E* and ratchet wheel *G* to rotate together. Now, as gear *E* is in mesh with gear *K*, gear *K* will rotate in a clockwise direction. When the rack reaches the end of its stroke, the automatic valves close for a predetermined time, thus holding the rack stationary and causing shaft *M* to dwell.

When the valves open, air is admitted to the opposite side of the piston and the rack moves toward the right. In doing so, pawl *H* rides over the teeth of ratchet *G*, and pawl *J* engages the teeth in ratchet *F*, causing gear *C* and ratchet wheel *F* to rotate together; and as gear *C* is in mesh with gear *K*, gear *K* will rotate in a clockwise direction as before. The movement of shaft *M* continues until the rack has reached the end of its stroke, at which time the automatic valves close once more to obtain the required dwell.

The angular movement of shaft *M* after each dwell depends upon the stroke of the rack and the ratio of the gears. In this case, all the gears have the same number of teeth; consequently, during one stroke, the travel of the rack must equal one-half the pitch circumference of gear *K*, or slightly more, to allow the pawls to engage properly.

* * *

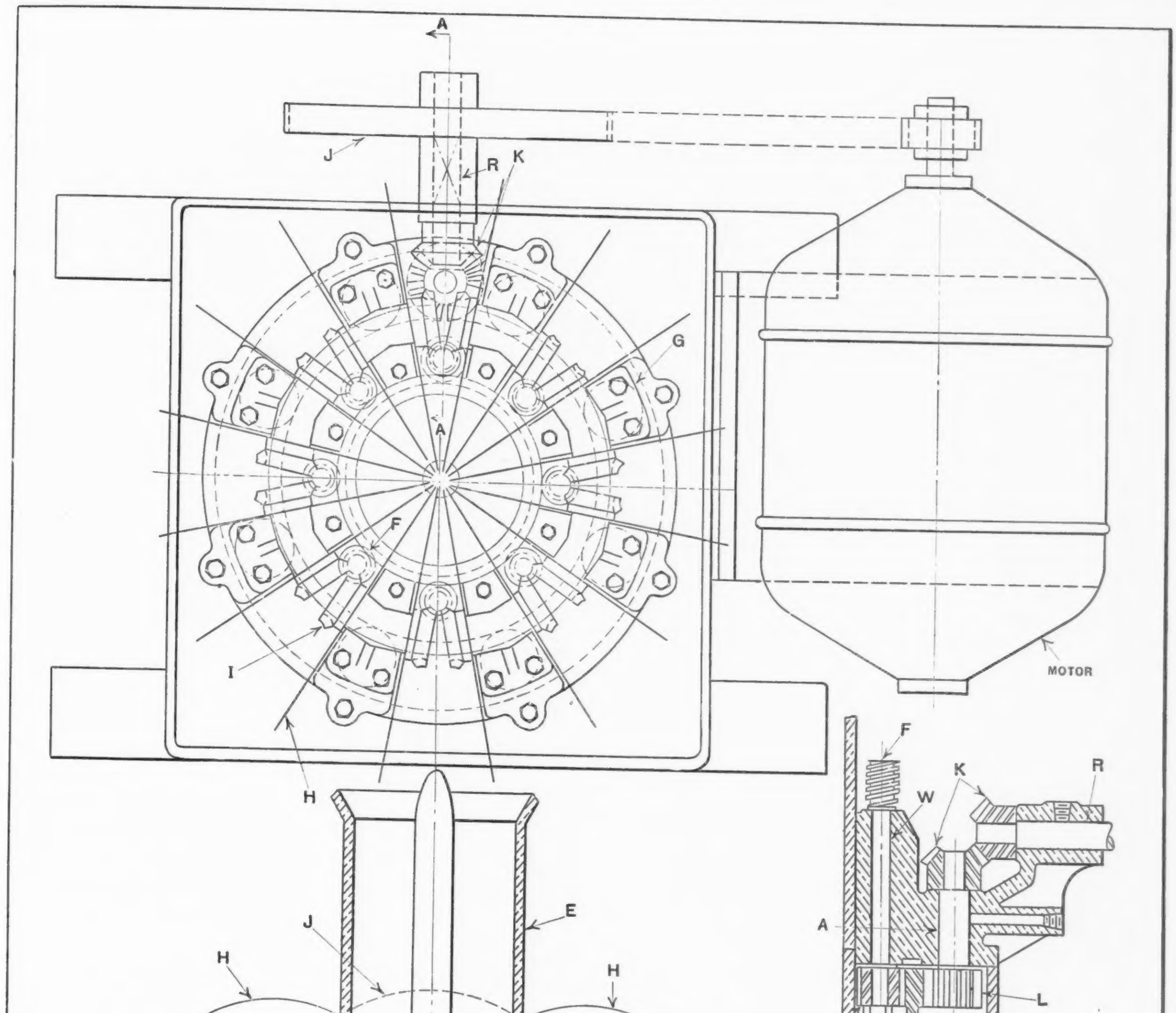
Multiple Worm-Gear Drive Obtained by Split Worm-Gears

By F. C. SCHOENING

In a machine employed for cutting pineapple slices into segments, a number of disk cutters operate in a position converging toward a common point. The cutters are located so close together that little room is allowed for the driving members for each cutter. To overcome this difficulty, one worm-gear, split in two and revolved by means of one steel worm, is used to operate two cutters.

The sliced fruit, through which a hole has previously been pierced, is placed over the spindle *B* in the tube *E*. As the fruit is pushed through the tube, it is cut into segments by the revolving cutters *H*. The cutters enter through clearance slots milled in the tube and the cutting edges enter grooves in spindle *B*.

Each disk cutter is secured to one-half of a worm-gear *I* which revolves freely on a stud fastened in one of the brackets *G*. These half-gears are driven in pairs by the worms *F*, fastened to the shafts *W*, which revolve in stationary brackets. All the worms receive their motion from the large ring gear *C*, meshing with the pinions *M* which are attached to the lower ends of the shafts *W*. Several radial ball bearings *D*, located an equal distance from the center of the machine, form a bearing for the ring gear. The outside diameter of the ring gear is equipped with teeth which mesh with the driving pinion *L* attached to shaft *A*, to which motion is imparted from the motor to revolve the ring gear.



Worm-gear Drive in which Two Split Worm-gears are Rotated by a Single Worm

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

WAGE incentives based on fair standards are essential to good management. Various bonus systems have been in successful operation for many years and are likely to be still more widely used in the near future. A bonus gives the worker an incentive to bring out his latent abilities. It is not merely a question of money. It creates a pride in ability and workmanship that is not easily brought out in any other way under our present-day industrial conditions. J. A. HONEGGER

Production Should Not Be Guaranteed

In June MACHINERY, page 747, the question of guaranteeing production was raised. There are too many variable conditions over which the machine tool manufacturer has no control to allow him to make any sort of positive production guarantee. Whether it be turret lathes, specialized drilling equipment, grinders, millers, lathes, or any other machine tool, the conditions are too uncertain for any conscientious manufacturer to guarantee so many pieces per hour from his machine without qualification.

Cutting tools always have a most important influence on production. If the tools are not ground properly or if they are not changed at the proper time, all sorts of upsets to production lines result. If the cutters have been burned in grinding, they will not produce. These are all things that come under the customer's control, and he should be responsible for them.

Different coolants should be used for grinding, turning, and tapping, yet many customers use the same coolant for all operations. This, of course, affects production.

The quality and uniformity of the stock obviously will affect production tremendously. Usually the customer's print specifies the material to be used, and he feels that this is the end of his responsibility. Nobody checks up on the "workability" of the stock received, so long as the cost of manufacture doesn't mount too high.

Recently one of our customers complained because he was unable to get the production we estimated. At different times two different demonstrators were sent to his plant and both reported that the machines functioned perfectly, but that hard spots in the material caused excessive drill breakage. It was eventually necessary for one of our engineers to follow this problem clear back to the point where the stock was manufactured in the steel mill. We located the trouble and should have been paid for our time and the expense involved, but we were forced to do it in self-defense, simply because the customer blamed the machine.

Incompetent operators, inefficient foremen, untrained set-up men, all cause production delays which are charged up against the machine tool until somebody "from the office" or the machine tool manufacturer is forced to check up. These are only a few of the many reasons why production should not be guaranteed. GEORGE G. HATHAWAY

How Engineering Books Help Designers

Too many designers, as well as others engaged in the mechanical industries, fail to realize the full value of mechanical publications, whether they be books or technical journals. Recently an engineer was developing a mechanical device different from anything that had ever been designed. Because of the fact that the development was entirely new, he believed that he could get no assistance in this work from the study of technical books.

There was a certain device in connection with the machine that proved particularly difficult. The designer worked on it for weeks without success until one day someone handed him a copy of "Ingenious Mechanisms for Designers and Inventors," suggesting that he might find some ideas in that book that would prove helpful to him. Although he was inclined to laugh at the suggestion that it would help him in work that, in his opinion, was breaking entirely new ground, he looked the book over.

A few days later he started in again to design the particularly difficult mechanism of his machine and found a successful solution. He did not get the solution out of the book, for there was nothing described in it that was like his finished product, but the book had given him a preliminary insight into a line of design with which he had no previous experience, and suggested ideas which gave him a start in working out his solution.

Too many men make the mistake of assuming that because a book or article does not bear directly upon the work that they are doing, it is of no value to them. But if a man possesses some imagination of his own, he is generally able to adapt methods used for other purposes to his own ends. The man who will not admit that he can be helped by knowing what somebody else has accomplished usually wastes both his own time and that of his employer.
CHARLES R. WHITEHOUSE

Making Joints with Electric Brazing Tongs

Heating the Joint between Electrodes Permits the use of Brazing Alloys with High Melting Points, thus Producing a Joint of Greater Strength

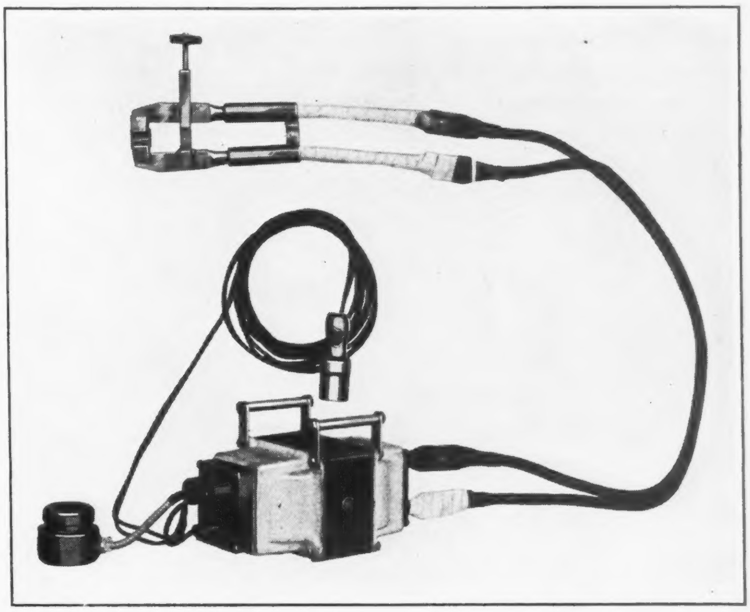


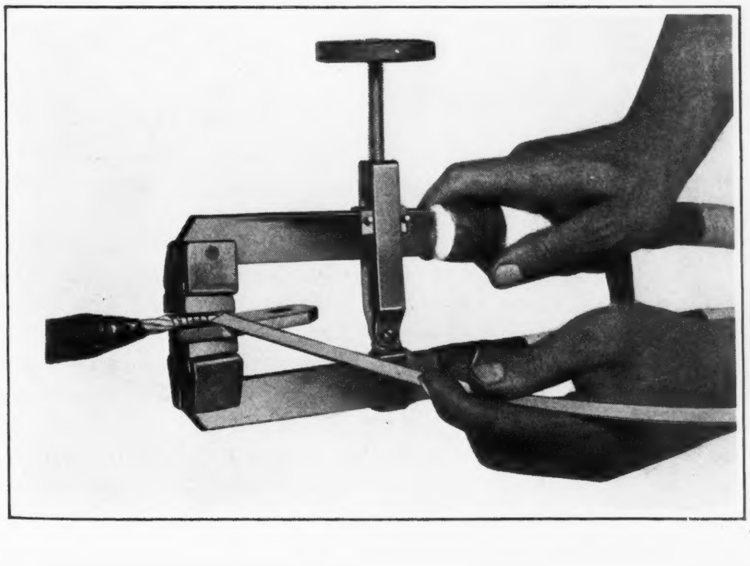
Fig. 1. Brazing Tongs, Transformer, and Foot-switch Used for Brazing by the Resistance Method

METAL joints of great strength and unusual neatness, such as are required for joining the ends of band saws, are produced rapidly by an electrical brazing process. This process—a development of the General Electric Co.—can be applied to nearly every form of metal in common use, including copper, nickel, silver, steel, and their alloys. The equipment used for this work (see Fig. 1) is of the portable type so that it can be used in different brazing positions. It consists chiefly of a transformer, hand brazing tongs, and a foot-operated floor switch.

In some respects, the process resembles that of electric spot welding, the parts to be joined being clamped rigidly between a pair of carbon electrodes, after which an electric current is passed through both the electrodes and the joint. An electrode is inserted in each jaw of the tongs and the clamping pressure on the work is obtained by tightening the handwheel. Immediately after the operator depresses the floor switch, the electrodes become heated up and the heat passes into the joint.

In Fig. 2 a flat terminal is shown being lap-joined to an electric cable. It will be seen that a thin strip of brazing alloy is being applied by hand around the edges of the contact surfaces of the parts. The heat of the parts causes the alloy to melt and flow through the joint, uniting the parts in one solid piece. However, before applying the alloy, a small amount of flux is distributed around the joint. Fused borax is generally used as a flux, but in some cases, potassium acid fluoride in paste form is more satisfactory. Another example of lap-joining is shown in Fig. 3. Here two brass bars of rectangular cross-section are being brazed together. In order to obtain an efficient lap joint, the length of the lap should be about one and one-half times the thickness of the parts.

Fig. 2. In Lap-brazing an Electric Terminal to a Cable, the Work is Heated between Electrodes and the Brazing Alloy Applied to the Edges of the Adjacent Surfaces



In making butt joints for parts of rectangular cross-section, special clamps are provided, as indicated in Fig. 4. These clamps support the parts in the correct alignment, the alloy strip being fed into the flat sides of the joint.

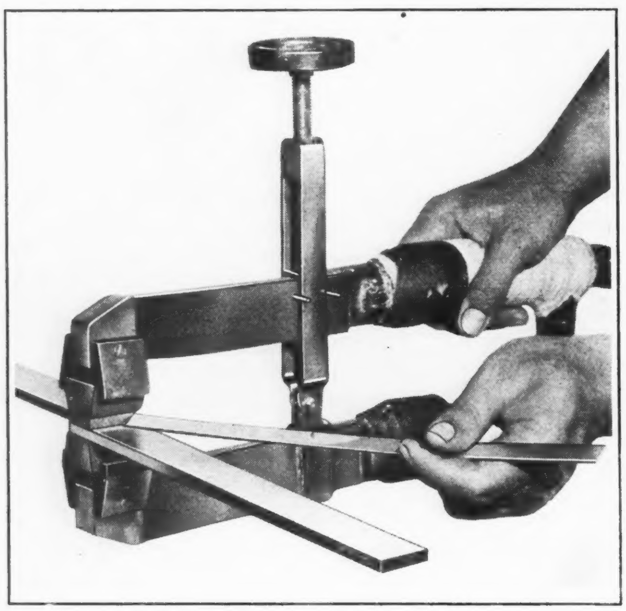
It is interesting to note that, in brazing copper parts, a thin copper film on the contact surfaces of the parts is melted, joining the molten alloy and forming a new alloy rich in copper, with a melting point higher than that of the original brazing alloy. This increases the factor of safety of the joint; and when used for transmitting electric current, this joint will carry a greater overload than the conductor itself—a fact, even if it seems paradoxical.

Precautions Required in Making Joints

Three different silver alloys having melting points of 1337, 1355, and 1526 degrees F., are used for these brazing operations; the alloy used for each job depends upon the type of work to be joined. For example, in brazing very small copper wire to terminals the alloy having a low melting point would be used, as a higher melting point would cause the wire or its insulation to be damaged. For joining heavier parts, however, the alloys having the higher melting points are usually employed.

To heat joints of comparatively large cross-sections, more time is required than for smaller sections and the current should be applied intermittently to allow the heat to be evenly distributed throughout the joint. Care must also be taken not to release the work from the tongs until the joint has cooled to a dull red; otherwise an inefficient connection will result. All surfaces to be brazed should preferably be flat to insure good contact with the electrodes and prevent arcing and "hot spots." In cases where the joint is not flat, the electrodes must be shaped to fit the irregular surface.

Fig. 3. Another Example of Lap-brazing, in which Long Bars of Rectangular Cross-section are Joined



Advantages of the Electric Brazing Process

This process possesses many advantages, one of which is that an absolutely clean surface is not essential. The reason for this is that the flux removes the oxides and the impurities. However, certain oils and varnishes are not eliminated by the flux and must therefore be removed. Speed of operation in making these joints is another desirable feature. Furthermore, the portable design permits the equipment to be easily carried from job to job, and in many cases, where the work is of large proportions or inaccessible, the tongs described can be employed successfully.

* * *

Automotive Production Meeting

Detroit has been selected as the place for the 1931 National Production Meeting of the Society of Automotive Engineers. The meeting will be held at the Book-Cadillac Hotel in that city, October 7 and 8.

In preparing the program for the meeting, the Production Activity Committee has made a special effort to schedule topics for discussion that will make the meeting profitable to production engineers and executives. The program has been so arranged that members from other cities may attend the meeting with a minimum amount of time away from their plants.

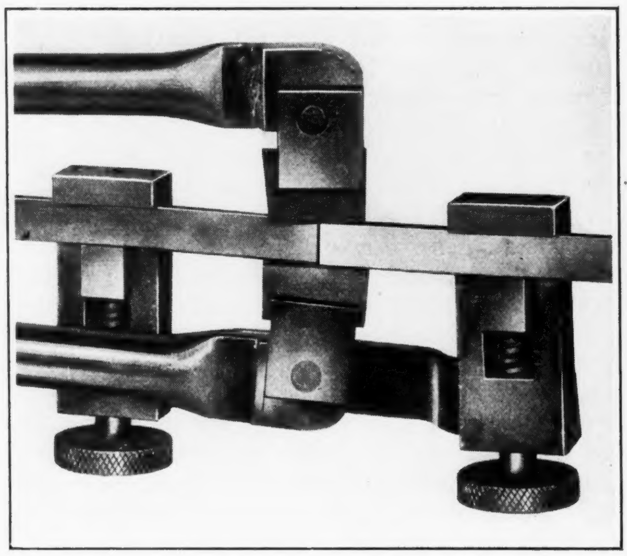
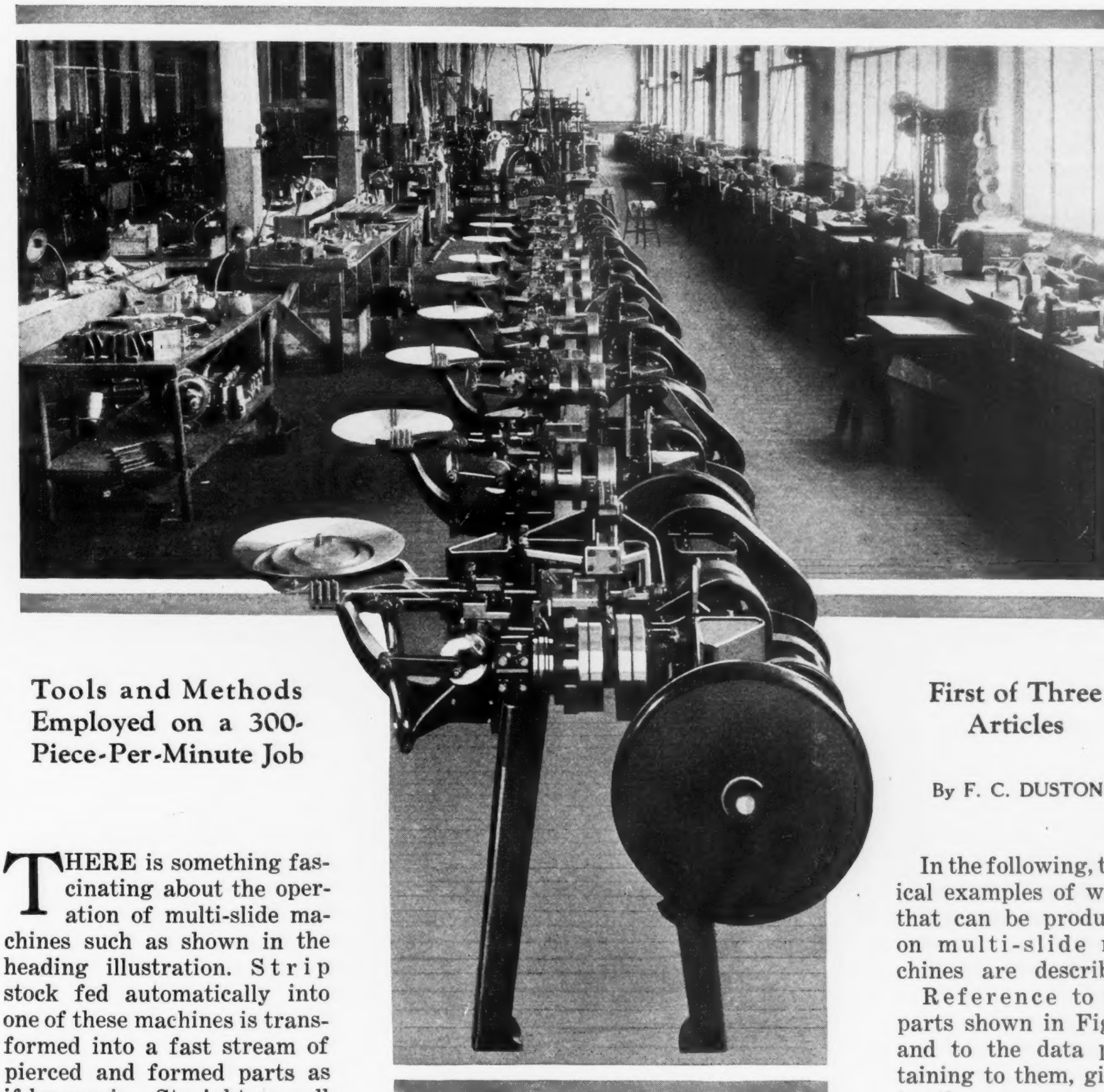


Fig. 4. Method of Applying Tongs in Brazing a Butt Joint, Showing how Bars are Held in Alignment

Five papers dealing with production and management problems and new developments in production equipment will occupy three technical sessions. The subjects to be discussed are various methods of welding, the cleaning and preparation of metal surfaces for coated finishes, the hot-coining of drop-forgings for greater accuracy and economy, the permanent mold casting practice, and inventory control in the plant. Arrangements will be made for visiting one of the automobile plants in Detroit, the plant having been selected especially for its interest to production engineers.

There will also be the usual Production dinner, informal, but with a speaker (not yet announced) that will have something worth while to say.

Multi-Slide Machine Speeds Production



Tools and Methods Employed on a 300-Piece-Per-Minute Job

First of Three Articles

By F. C. DUSTON

THERE is something fascinating about the operation of multi-slide machines such as shown in the heading illustration. Strip stock fed automatically into one of these machines is transformed into a fast stream of pierced and formed parts as if by magic. Straight as well as coiled strips of brass, steel, phosphor-bronze, and other metals, obtainable in a wide range of widths and thicknesses, can be turned into finished parts at exceptionally high production rates by these machines and with a minimum expenditure for tool equipment. Multi-slide machines of the type illustrated were introduced to the trade by the U. S. Tool Company, Inc., Ampere, N. J., in June MACHINERY, page 803.

Although not previously described in technical magazines, a considerable number of these machines have been developed and built by this company for use in the plants of well-known manufacturers of widely distributed products. Manufacturers of radio sets, for example, are using these machines for making the parts shown in Fig. 1.

In the following, typical examples of work that can be produced on multi-slide machines are described. Reference to the parts shown in Fig. 1 and to the data pertaining to them, given in the accompanying table, will give some idea of what is being accomplished by multi-slide machines. The pierced and notched strips directly below the pieces *A* to *N* show what happens to each strip of stock while it is passing from the straightening rolls to the final position, where it is cut off and formed into finished pieces.

The finished piece *O* is an example of unusual interest, in that it represents a combination of forming and assembling operations. This particular part is the plate of a radio tube. It is formed from two strips of coiled stock fed automatically into the multi-slide machine shown in Fig. 2, which forms the two ribbed pieces and assembles them by a combination piercing and lug-forming operation. The pieces thus formed and assembled are cut off

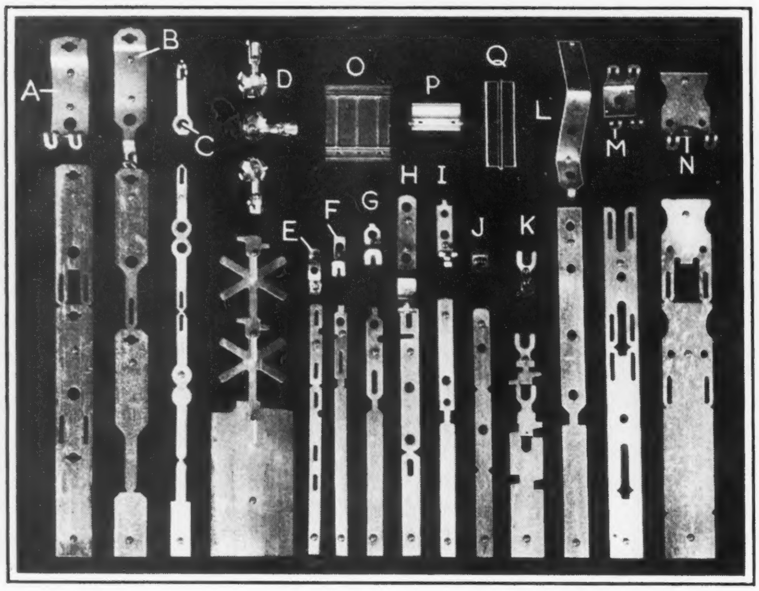


Fig. 1. Examples of Parts Produced on Multi-slide Machines

to length and ejected from the machine into the work-box, all operations being performed automatically. The parts shown at *P* and *Q* are of one-piece construction with their ends held together by means similar to those that are employed for the part *O*.

How High-Speed Production of Complicated Parts is Accomplished

Just a word about the basic design of the multi-slide machines will show why they have proved so successful in the high-speed production of accurate parts of complex form having closely spaced holes or irregular shaped profiles. Briefly, the effective handling of this class of work is made possible by the positive and accurate stock advancing or feeding mechanism employed and the fact that the machine is so designed that any required number of dies for piercing, bending, or forming can be used. The dies can be located in the most advantageous positions with respect to the stock as it is advanced from the blanking position to the final finish-forming position.

The latter feature is made possible by designing the machine with four camshafts which practically surround the work. Any required number of cams can be arranged on these shafts for operating tool-carrying slides or cutter-heads such as shown in Figs. 7 and 8. Slides operating in a vertical or angular position are actuated by simple bellcrank levers provided with

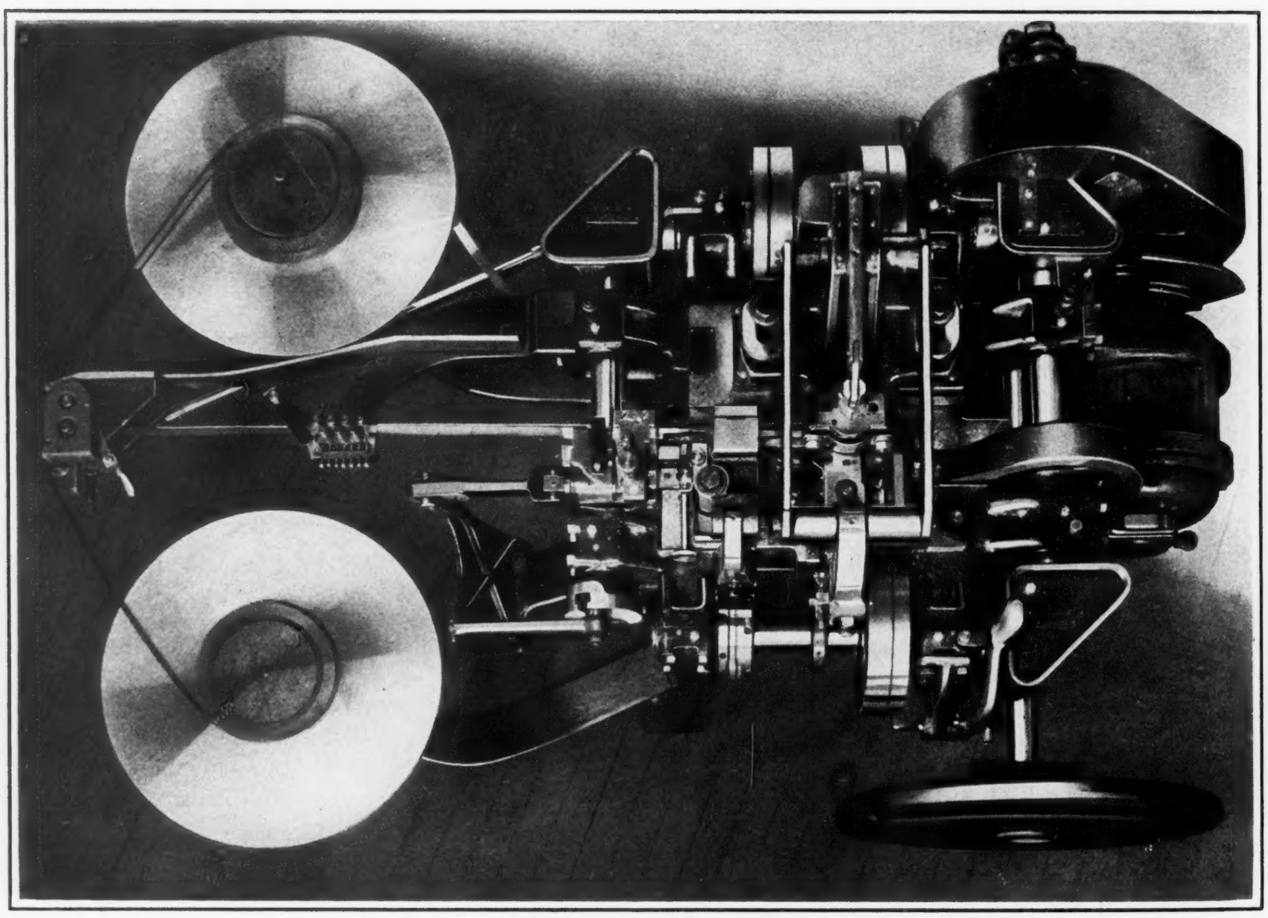


Fig. 2. Multi-slide Machine Equipped to Emboss, Form, Assemble, and Cut Off Part O, Fig. 1

follower rolls operated by cams on the horizontal camshafts. The camshafts are driven through spur and bevel gears by the motor mounted on the machine base. The spur gears are of the pick-off type, which permit the speed of the machine to be changed readily. Thus the power is delivered directly through gears and cams to only those slides actually performing useful work. With this arrangement no power is lost in driving idle or unnecessarily heavy slides or rams.

Data on Samples of Multi-Slide Machine Work Shown in Fig. 1

Part (See Fig. 1)	Kind of Material	Temper of Stock	Width of Stock, Inches	Length of Feed, Inches	Thickness of Stock, Inches	Number of Operations	Completed Pieces per Minute
A	Bronze*	8	9/16	2 1/16	0.025	3	125
B	Bronze	8	1/2	2 3/8	0.025	3	125
C	Brass	1/4 hard	5/16	2 5/32	0.020	3	125
D	Bronze	8	1 1/4	1 7/32	0.015	4	125
E	Brass	1/2 hard	3/16	1 3/16	0.020	3	125
F	Brass	1/2 hard	3/16	1 1/8	0.020	2	125
G	Brass	1/2 hard	1/4	1 7/16	0.020	2	125
H	Brass	1/2 hard	9/32	2 5/32	0.035	3	125
I	Brass	1/2 hard	1/4	1 3/4	0.062	2	125
J	Bronze	6	1/4	1 3/16	0.020	3	125
K	Brass	1/2 hard	1/2	3/4	0.020	4	300
L	Brass	1/2 hard	3/8	3 5/32	0.062	2	125
M	Brass	1/2 hard	1/2	2 1/16	0.020	3	125
N	Brass	3/4 hard	3/4	1 1/2	0.031	4	125

*Phosphor-bronze

Low Tool Costs

The use of small die set units, often built up in sections, and separate forming and bending tools not only permits the tools to be constructed at low cost, but also permits them to be easily adjusted or changed to suit modifications in the design of the piece or in the kind of material from which it is made.

Dies and Forming Tools for Typical Job

The tool equipment of the machine which produced the part shown at *K*, Fig. 1, is illustrated in Figs. 3, 5, and 6. The upper view in Fig. 5 shows a plan view of the assembled piercing and blanking die, with the end sections of the forming punches shown to the right. Below the blanking die assembly is a strip of stock *T* which has been advanced through the four operation stages, so that the blanked piece at the fourth position is ready to be cut off and formed to the shape indicated by the view at *W*. The same reference letters are used in Figs. 3 and 5.

Light extension lines in Fig. 5 divide the strip into the areas operated upon at each position. These lines extend to the corresponding positions on the assembled die and to the plan view of the die *B* shown below the strip. The shaded areas show the portions cut out or pierced at the first, second, and third operation positions.

After leaving the revolving table or stock reel, the stock passes through the straightening rolls and is gripped by the clamp of the feeding mechanism. At each forward movement this mechanism feeds the stock ahead a distance equal to the length of the piece before forming. Assuming that the end of the stock has been advanced to the position for the first operation, the cam-operated clamp *A* is advanced so that it clamps the strip securely against the die *B*. While the stock is securely held in this position, the punch member *C* is advanced and redrawn by the action of a cam on the front camshaft. This results in notching the stock at *D* and piercing it at *E*. While this operation takes place, the clamp of the feeding mechanism has been automatically released and returned to the starting position.

The feeding clamp again tightens on the work

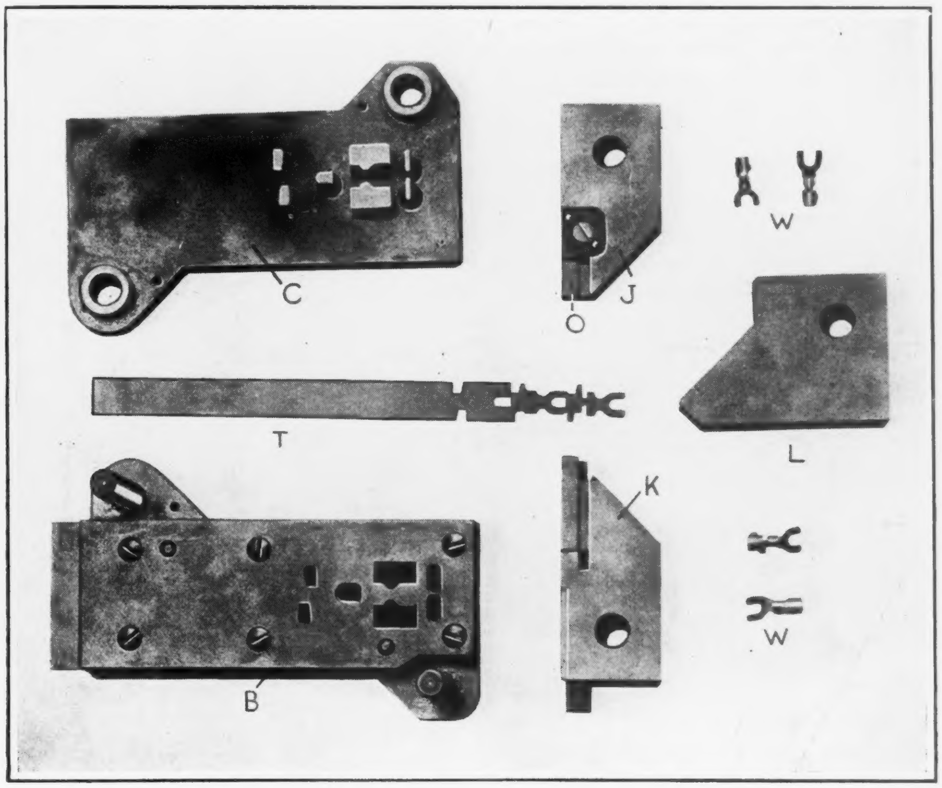


Fig. 3. Blanking, Piercing, and Forming Tool Equipment used on Multi-slide Machine for Producing Part W, Shown also at K, Fig. 1

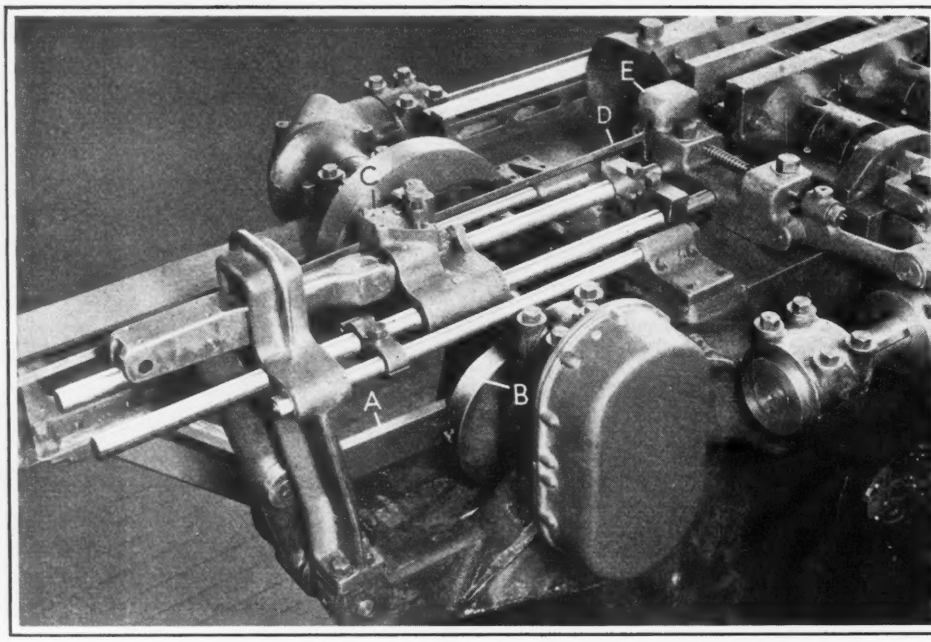


Fig. 4. Stock Feeding and Clamping Mechanisms of Multi-slide Machine

and repeats the forward feeding movement, carrying the part that was notched and pierced at the first operation position to the second position, where the punches remove the stock indicated by the shaded portions *F*. The next feeding movement brings the end of the strip to the third operation position, where the shaded portions *G* are removed by notching punches.

The fourth feeding movement brings the blanked out part into the position shown at *H* in the upper view, where the forming operation is performed. The forming tools *J* and *K* are advanced from opposite sides by cam-operated slides. The forming tool *K* is of built-up construction,

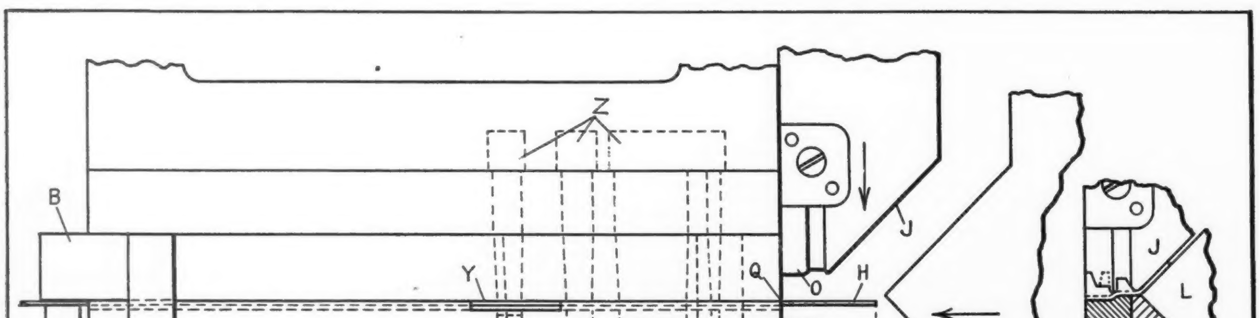


Fig. 5. View Showing How Tools Illustrated in Fig. 3 are Assembled, and How they Operate in Producing Part W

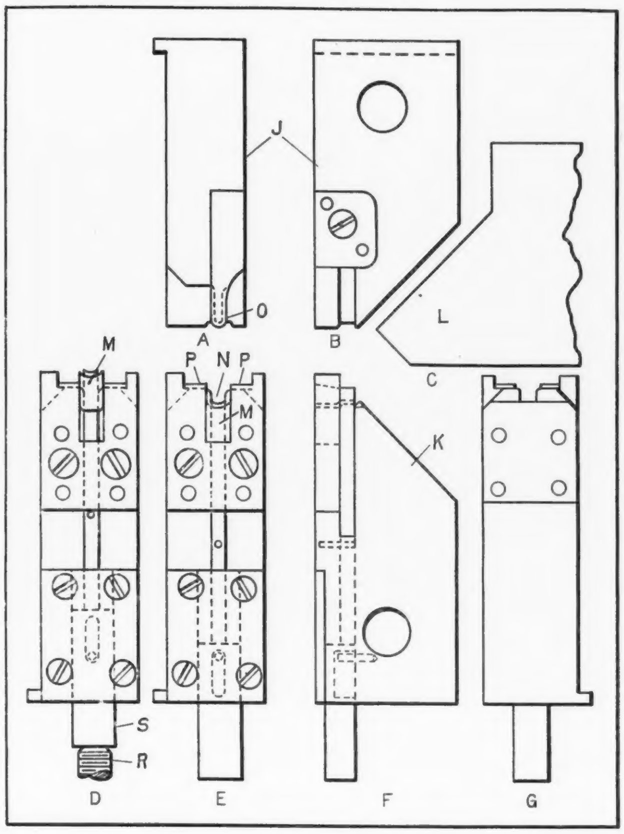


Fig. 6. Details of Punches J, K, and L, Figs. 3 and 5, Which Cut Off and Form Part W

which is shown in greater detail by the four lower views in Fig. 6. The views at *A* and *B* show the forming tool *J*, Fig. 5, while the view at *C* shows the end of the tool *L*.

Referring to Fig. 5, it will be noted that the tool *K* has an ejector *M*, which is shown in the forming position indicated in view *E*, Fig. 6. This forms a U-shaped slot at *N*, which forces the work over the formed end *O* of the tool *J*, while the cutting edges *P* on either side of the U-shaped forming notch cut off the piece on the shearing edge of the die at *Q*, Fig. 5. As soon as tools *J* and *K* have reached the end of their forming strokes, the tool *L* advances and bends the end of the part to the shape or angle shown in the view at *W*. The positions of the forming members *J*, *K*, and *L* on completing the forming operations are shown in the view in the upper right-hand corner of Fig. 5.

When the forming tools are withdrawn, the slide *S*, Fig. 6, comes in contact with an adjustable set-screw *R*, which causes the ejector *M* to remain stationary while the body *K* of the tool recedes. This results in ejecting the part from the forming tool *K* so that it is blown downward into a tube that conveys it to the work-box. The air blast which performs this operation is controlled by a properly timed, cam-actuated valve. Another air pipe with the terminal in the slot at *Y*, Fig. 5, serves to eject the piercing and scrap stock through openings *Z* in the bolster plate to which the die is secured. The production rate on this particular job is 300 pieces per minute.

Although the feeding mechanism and stock clamp or check shown in Fig. 4 are of a slightly different model from the ones used on the job described, the operating principle is the same. Referring to Fig. 4, the rod *A* is connected to an adjustable crankpin on the revolving disk *B* and transmits a reciprocating movement to the stock-feeding member *C*. The cam-operated check or positive clamp which holds the strip stock *D* stationary during the return stroke of member *C*, is shown at *E*.

* * *

A survey to determine present practice in industry with respect to the speeds of driving and driven machinery is being made by a committee on speeds of machinery, acting under the procedure of the American Standards Association. The committee has sent out a questionnaire and expects, from the information gained in this way, to establish standard speeds of transmission shafting and of driven machines; standard diameters of pulleys and of gears and chain sprockets; standard widths of pulleys and belts; and standard belt speeds. Those who wish to contribute to the work of the committee are invited to address F. S. English, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

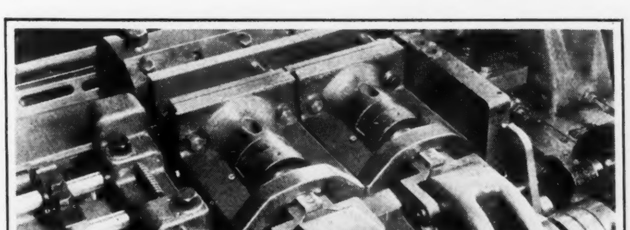


Fig. 7. Front View of Multi-slide Cutting Head

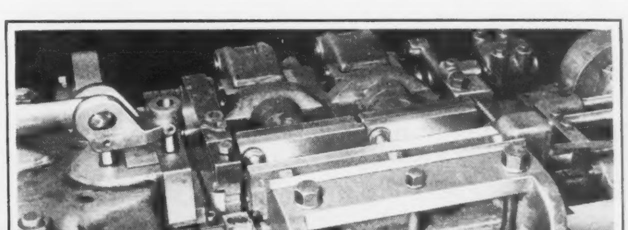


Fig. 8. Rear View of Cutting Head Shown in Fig. 7

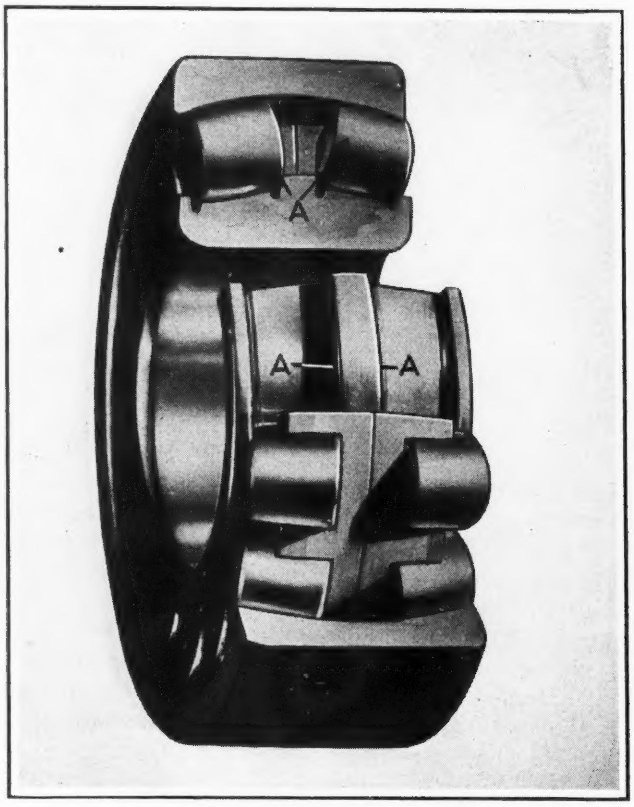
Lubrication of Ball and Roller Bearings

Results of Extensive Tests Conducted to Determine the Proper Lubricants and Methods of Application According to the Operating Conditions

By H. E. BRUNNER, Chief Engineer
S K F Industries, Inc., New York City

TO obtain the full measure of efficiency and service from ball and roller bearing equipment, the kind and quality of the lubricant, as well as the system of applying it, must be adapted to the design of the bearing, the design of the machine, and the operating conditions. The smooth-running qualities of anti-friction bearings are due to the accuracy with which the parts are fitted and their highly finished surfaces. Thus, to maintain the efficiency of anti-friction bearings, they must be protected against rust and corrosion. The lubricant must, therefore, be free from corrosive agents and must serve to protect the bearing from corrosion as well as wear.

Factors other than the physical and chemical properties of the lubricant, such as the operating load, speed, type of bearing, and surrounding temperature, are important from the standpoint of their effect on the operating temperature, which is usually the controlling consideration in the choice of any oil or grease. The frictional resistance in a ball or roller bearing increases with the load and speed, and unless oil of the proper viscosity or a grease of the correct consistency is supplied in proper amounts, the increase in the normal operating temperature may be serious.



S K F Self-aligning Spherical Roller Bearing

The S K F Industries, Inc., have conducted extensive tests to determine the most efficient lubricants for ball and roller bearings operating under different conditions, and it is the object of this article to give a brief summary of the results of these tests with a view to assisting the user in selecting the proper lubricant.

Operating Temperatures

Under ordinary conditions the temperature of a bearing while running will be from 10 to 60 degrees F. above that of the room. If it exceeds 125 degrees F., ordinary greases will frequently prove unsatisfactory. They will tend to soften and flow continuously into the path of the rolling elements, causing a rise in the normal operating temperature due to the increased frictional resistance introduced. This may eventually result in the separation of the oil and soap base, with a complete loss of lubricating qualities. In some cases, greases developed for use at high temperatures may be employed. Care should be taken, however, to see that they meet all the requirements for adequate lubrication.

Mineral oil of proper physical and chemical properties is an ideal lubricant for ball and roller bearings when the housing is designed to control the quantity entering the bearing and to prevent leakage and protect the bearing from the entrance of foreign matter. A ball or roller bearing should not be subjected to temperatures in excess of 300 degrees F., because there will be danger of drawing the temper of the hardened steel races and balls.

Classification of Oils and Greases

Viscosity is the governing physical property of oil, and "consistency," or stiffness, is the governing physical property of grease. Both of these properties vary with the temperature, so that it is extremely important to consider the actual temperature developed in a bearing during operation in order to select a suitable oil or grease.

The classification of the oils referred to in this article, including the accompanying tables, arranged according to their viscosities, as determined by a Saybolt standard universal viscosimeter at 100 degrees F., is as follows:

Extra Light..................135 to 165 Seconds
Light ....180 to 220 Seconds

Table 1. Lubricating Oils for Ball Bearings Operated at High Speeds

Radial Load on Bearing, Pounds*	Revolutions per Minute and Permissible Shaft Sizes				
	5000 60 mm.	7200 50 mm.	10,000 40 mm.	15,000 30 mm.	20,000 25 mm.
10	Spindle oil	Spindle oil	Spindle oil	Spindle oil	Extra light
25	Spindle oil	Spindle oil	Spindle oil	Extra light	Light
50	Spindle oil	Extra light	Extra light	Light	....
100	Extra light	Light	Light	Medium	....
200	Medium	Medium	Heavy	....	....
300	Medium	Heavy	....	....	....

Greases are also used under these conditions, the suitability of any grease being best determined by actual trial.

*For thrust loads, multiply the actual load by 4, and enter the table with this value of load.

Medium.................... 270 to 330 Seconds
Heavy...................... 360 to 440 Seconds
Extra Heavy................ 450 to 550 Seconds
Steam Cylinder and Valve Oils 2000 to 2500 Seconds

The manufacturers of greases arbitrarily classify the consistency of their products by a number, as, for example, No. 1, No. 2, and No. 3. For the average application at operating speeds up to 3600 revolutions per minute, a grease of soft consistency, such as a No. 2 grease, will usually be found satisfactory, provided it is suitable in other respects. Hard greases, such as No. 3, may be used if the grease is to serve as a packing medium around the shaft to prevent the entrance of dirt, water, or other corrosive substances.

It should be realized, however, that a hard grease has a tendency to "channel" and stand off from the rotating elements, and therefore must be used with caution. For speeds above 3600 revolutions per minute, special care must be taken in choosing a grease. The housing must be carefully designed so that the grease will be fed to the bearing in the most effective manner and in the proper quantity.

Effect of Temperature on Viscosity

When a bearing is run under high-temperature conditions, a heavier oil should be used than when the same bearing runs at low temperatures. If too light an oil is used, it may be dissipated from the bearing too quickly by atomizing or evaporation. At high speeds, an oil of high viscosity will cause the development of excess heat. Likewise, a grease that is too heavy may "channel" and fail to lubricate or protect the rotating elements properly. Bearings that operate under very low temperature conditions should be lubricated with a medium oil of low pour test. The accompanying tables are offered as a practical guide for the proper selection of oils and greases to meet given conditions of load and speed.

Quantity of Lubricant Required

In no case does a ball or roller bearing require a large quantity of lubricant. On the contrary, a few drops of oil or a corresponding amount of grease, properly distributed over the running surfaces of the bearing, will provide satisfactory lubrication for a considerable period of time. A large volume of lubricant within a bearing will usually result in high operating temperatures, due to the working or churning of the lubricant by the rolling elements and retainer. This may seriously impair the useful life of the lubricant through oxidation or sludging of the oil or actual disintegration of greases.

Satisfactory lubrication of horizontal shafts operating at speeds below 3600 revolutions per minute will usually be attained if the level of the oil is kept about the center of the lowermost ball or roller in the bearing. The oil can be kept at this level by a tell-tale level plug, a sight gage, or an overflow pipe. On vertical shafts, some form of flinger is usually employed to raise the oil from a reservoir in the bottom of the housing to the surfaces of the bearing.

If grease is used, the housing should not be kept more than one-fourth to one-half full of the lubricant. Unlike oil, there is no way of controlling with any degree of exactness the quantity of grease in a housing, and greater care must therefore be taken to avoid overloading. A bearing that runs at too high a temperature will often return to normal temperature if some of the lubricating grease is removed.

At high speeds, that is, speeds above 3600 revolutions per minute, control over the quantity of lubricant becomes very important. With oil lubri-

Table 2. Lubricating Oils for Ball and Cylindrical Roller Bearings

Radial Load on Bearing, Pounds*	Revolutions per Minute					
	100	300	600	1200	1800	3600
50	Light	Light	Light	Light	Medium	Medium
100	Light	Light	Light	Medium	Medium	Medium
500	Light	Light	Medium	Medium	Medium	Heavy
1,000	Medium	Medium	Medium	Heavy	Heavy	Heavy
2,000	Medium	Medium	Heavy	Heavy	Extra heavy	....
5,000	Medium	Heavy	Heavy	Extra heavy	....	....
7,500	Heavy	Heavy	Extra heavy	....	....	....
10,000	Heavy	Extra heavy	....	....	....	....
15,000	Extra heavy	Extra heavy	....	....	....	....

Greases are also used under these conditions. It is suggested that generally a No. 2 grease can be used when a light or medium oil is specified, and a stiffer or high-temperature grease when heavy and extra heavy oil is called for.

*For thrust loads, multiply the actual load by 4, and enter the table with this value of load.

cation, different forms of wick feeds have been found convenient and highly satisfactory both for regulating the flow and filtering out any foreign matter that may be in the oil.

Grease is being used successfully for the lubrication of ball bearings at high speeds, but great care is necessary, both from the standpoint of housing design and selection of the lubricant, in order to obtain satisfactory results. Any system employed must be designed to feed only a limited amount of grease to the bearing.

Lubrication of Roller Bearings

Roller types of anti-friction bearings generally provide a guiding reaction to assure proper alignment of the rollers with the races. Usually this is obtained by contact between the end or head on the rollers and a suitable guiding flange on the inner race. Since this contact must involve some degree of sliding action, it is necessary to lubricate these surfaces, and provision must be made for free access of the lubricant. An oil film must be maintained to support the guiding pressure at the operating speeds and temperature.

Spherical roller bearings with two rows of rolling elements, as shown in the illustration on page 30, have a central guiding flange on the inner race. With this type of bearing, it is imperative that the lubricant penetrates effectively to the guiding surfaces at *A;* otherwise, these surfaces will become smeared, due to the sliding contact, and failure will ultimately follow.

Oil is generally recommended for spherical roller bearings, as indicated in Table 3, although grease may be used under certain conditions of load and speed, as specified in the footnote to Table 1.

When Lubricant Should be Renewed

While the consumption of oil or grease in ball or roller bearings is relatively small, suitable provision must be made in the housing for periodical renewal. Aside from the loss due to evaporation, leakage, etc., an oil or grease is always subject to deterioration according to the severity of the operating conditions. The extent to which dirt, dust, moisture, or other foreign substances gain access to the bearing will influence the frequency with which renewal must be made. Operating temperature and mechanical working of the lubricant by the bearing will also affect the useful life of the lubricant. When the operating conditions are unfavorable and the lubricant cannot be renewed at frequent intervals, the housing should provide for a larger volume of grease or oil than for ordinary service.

In general, lubricant can be applied and the housing sealed for a period ranging from three months to a year. In the absence of definite data, the necessity for renewal can be best determined in any particular case by periodic inspections during the first year of service. The most destructive agents in limiting the life of an anti-friction bearing are dirt and abrasive materials. If these find their way into the bearing housing, the lubricant should be drained or washed out, the bearing thoroughly cleaned, and new lubricant applied. When it is necessary to remove the lubricant from ball or roller bearings, the old lubricant should always be completely drained out.

Table 3. Lubricating Oils for Spherical Roller Bearings

Load on Bearing, Pounds	Revolutions per Minute						
	100	300	500	750	1000	1400	1800
500	Heavy	Heavy	Heavy	Extra heavy	Extra heavy	Extra heavy	Extra heavy
1,000	Heavy	Heavy	Extra heavy	Extra heavy	Extra heavy	Extra heavy	Cylinder oil
2,500	Heavy	Heavy	Extra heavy	Extra heavy	Extra heavy	Cylinder oil	Cylinder oil
5,000	Heavy	Extra heavy	Extra heavy	Extra heavy	Cylinder oil	Cylinder oil	Cylinder oil
10,000	Heavy	Extra heavy	Extra heavy	Cylinder oil	Cylinder oil	....	....
15,000	Extra heavy	Extra heavy	Cylinder oil	Cylinder oil	....	....	....
25,000	Extra heavy	Cylinder oil	Cylinder oil	Cylinder oil	....	....	....
50,000	Cylinder oil	Cylinder oil	Cylinder oil	....	....	....	....
100,000	Cylinder oil	Cylinder oil	....	....	....	....	....

Grease may be used in those cases where heavy oil is specified and when the housing design is such as to insure lubricant being fed to both sides of the bearing.

* * *

Calibrating Abrasive Testing Screens

The Technical Committee of the Producers of Electric Furnace Abrasives has just completed a research program at the United States Bureau of Standards on the subject of calibrating testing screens for abrasives. The usual certified screens of the Bureau were found to be too inaccurate for abrasives testing, and master screens of closer tolerances have been selected and deposited at the Bureau to assist in future selection of test screens for the manufacturers and users of loose abrasives. This is an excellent illustration of cooperation within an industry. The cooperating companies are: Abrasive Co., American Abrasive Co., American Emery Wheel Works, Carborundum Co., Exolon Co., Federal Abrasives Co., General Abrasive Co., and Norton Co.

Roller Cages Made From Duralumin Blocks

By CHARLES O. HERB

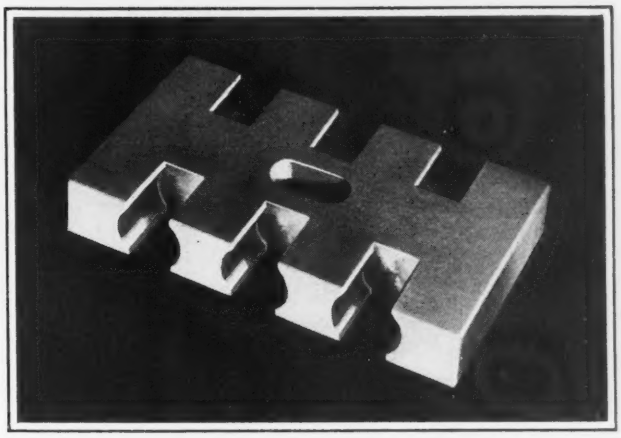


Fig. 1. Roller Cage Produced from a Plain Duralumin Block in Two Operations

ROLLER cages of the design illustrated in Fig. 1 are produced by the Oilgear Co., Milwaukee, Wis., from plain blocks of Duralumin measuring 3 7/8 inches long, 2 1/8 inches wide, and 5/8 inch thick. The first operation is performed with the equipment illustrated in Fig. 2, which is provided on an Oilgear-equipped multiple-spindle drilling machine of vertical construction. The plain Duralumin blocks are loaded into slots in the seven-station jig at position *A*.

This jig is of a hand indexing design, and is locked in each position by a plug *B* which enters a hole adjacent to the work slot. It is not necessary to clamp the blocks, because they fit the slots snugly and cannot move endwise or sidewise. The bushing plate keeps them from being lifted with the tools.

At the first station to which each piece is indexed after the loading, the two end slots are drilled in the top of the piece to a diameter of 5/8 inch and to a depth of the same dimension. Then the fixture is again indexed approximately 51 1/2 degrees and a similar slot is drilled between the two slots just produced.

At the third station, flat-end drills square the bottom of the two end slots, while the bottom of the middle slot is squared in a similar manner at the fourth station. The two end slots are reamed to

Fig. 2. Equipment Used in Drilling, Spot-facing, and Reaming the Circular Slots in Both Edges of the Roller Cage

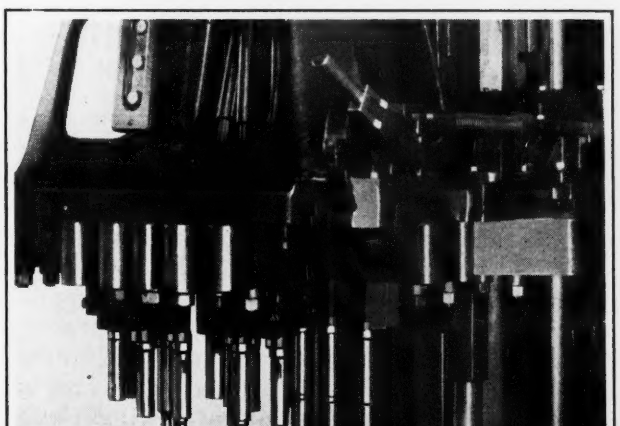
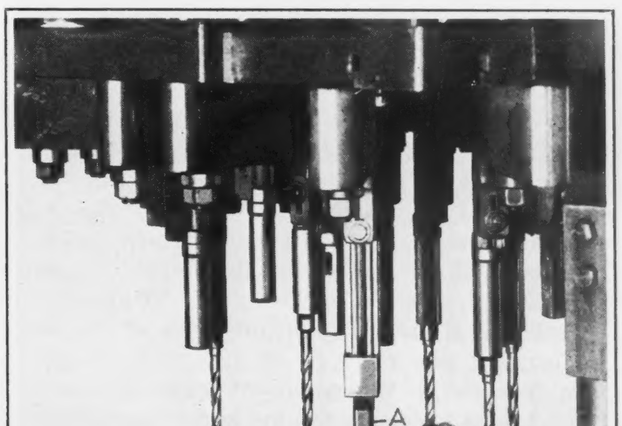


Fig. 3. Set-up for Performing Drilling and Broaching Operations on Elongated Hole through Middle of Roller Cage



41/64 inch diameter at the fifth station and the middle slot is reamed similarly at the sixth station. The depth of the holes is maintained to close limits by feeding the drill head against a positive stop and reversing at a predetermined pressure.

When each piece reaches the unloading station, it is turned end for end for a second pass beneath the tools, during which the opposite edge is machined in the same manner. The production in this operation averages thirty complete pieces per hour, as compared with nine per hour on a single-spindle machine. This high production is due to the semiautomatic Oilgear operation of the drill head and to the fact that clamping of the work is not required. Coolant is delivered to each tool through passages in the top of the work fixture.

The hydraulic equipment feeds the head downward rapidly until the tools are about to touch the work pieces, then slows it down to a suitable feed for the cuts, and finally returns it rapidly to the starting point. The drill head is started by the handle seen at the right-hand end of the head.

Hydraulic Operation Permits Broaching in Combination with Drilling

After a number of parts have been put through the first operation, the fixture shown in Fig. 3 is substituted preparatory to cutting the elongated hole in the side of the work. The fixtures can be changed rapidly, as they are mounted on a table *C*, Fig. 2, which can be quickly pulled forward from beneath the drill head after clamps *D* have been released. The table slides on rollers.

In the second operation, as in the first, it is unnecessary to clamp the work pieces. They are merely slipped into snug seats that prevent endwise or sidewise movement, and in this case also, a jig bushing plate prevents them from sticking to the tools. After a piece has been loaded and indexed to the first working position, a hole 3/8 inch in diameter is drilled entirely through the part to form one end of the slot. Then, at the second station, a similar hole is drilled at the opposite end of the slot, while, at the third station, a hole is drilled in the middle.

Flat-end drills at the fourth and fifth stations remove small projections of stock left by the previous drills along the slot sides. These drills pass through the work in the manner of end-mills, whereas if they were standard drills with conical ends, they would tend to deflect.

An important step in this operation is that performed at the sixth station, where broach *A*, Fig. 3, is employed to smooth the sides of the slot and remove all burrs.

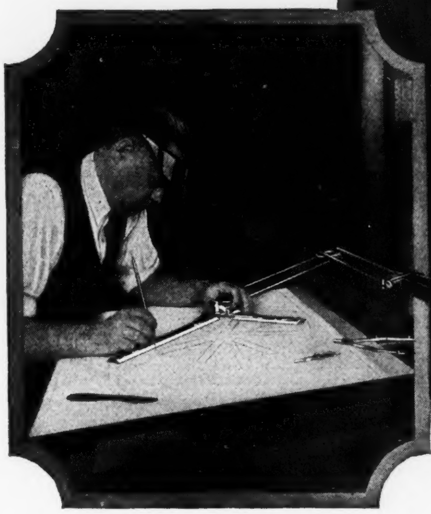
The production in this operation averages 120 pieces per hour, as compared with 60 per hour when drilling and milling each piece. This is much higher than in the first operation due to the fact that the parts are passed only once around the fixture. As in the case of the first operation, the pump and feed cylinder are employed for traversing the tools rapidly to the work, feeding them slowly for the cuts, and returning them rapidly to the starting position. The indexing and locating means are the same as with the first fixture, and coolant is supplied to the tools in a similar manner. Normally, the tools used in this operation extend into the fixture bushings, and are not withdrawn as shown in the illustration.

Nickel Plays Important Part in Automotive Plants

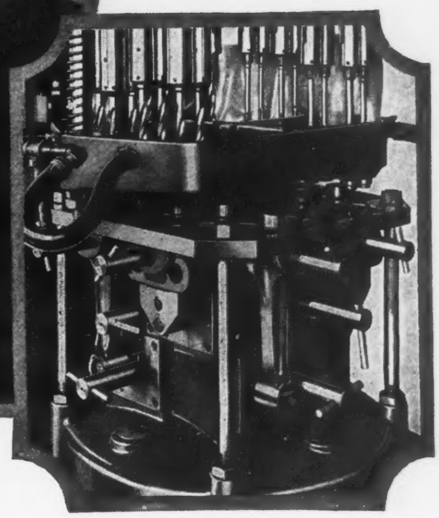
The nickel consumed in the automotive field represents an appreciable percentage of all the nickel produced. Besides being used in alloy steels, cast iron, and for plating, nickel is used for spark plug wire, resistance wire, for certain types of stainless steel, in heat-resisting alloys for valves, and as an ingredient of nickel silver. It also occurs in Monel metal. Low expansion steels of the Invar type contain about 34 to 36 per cent of nickel. Nickel is also an ingredient of some of the aluminum alloys used for pistons and cylinders, such as the "Y" alloy and the "Lo-Ex" alloy made by the Aluminum Co. of America. Nickel-aluminum bronze is also used for valve seats.

According to Thomas H. Wickenden, of the International Nickel Co., Inc., who recently read a paper before the Society of Automotive Engineers at Milwaukee, the use of nickel cast-iron dies for drawing sheet-metal parts has recently proved an effective means for increasing the life of such dies and improving the finish of the parts produced. Nickel is also an essential constituent in many drop-forge die-blocks, in the resistant elements of electrical furnaces, and in the heat-resisting castings of heating furnaces, as well as in carburizing boxes.

In the foundry, some of the advantages that can be secured by the proper use of nickel by itself or in combination with other alloy elements are: Refining of the grain by producing finer graphite flakes and the securing of a high luster on a finished surface; the reduction of porosity and internal shrinkage to obtain pressure-tight castings; elimination of hard spots in gray iron, thereby improving the machineability; increasing the hardness of gray iron, especially in the heavier sections; retaining the machineability at hardnesses of over 300 Brinell; equalizing the hardness of thick and thin sections, thus resulting in a reduction of casting strains and less subsequent warpage; securing remarkable resistance to abrasion; obtaining stability of composition, strength, and hardness at elevated operating temperatures; and increased strength of iron castings in general.



Design of Tools and Fixtures



Jig for Boring Holes Parallel

By CHARLES C. TOMNEY, Chief Tool Designer
Brunswick-Kroeschell Co., New Brunswick, N. J.

Interchangeability of crankpin bearing caps requires that the bolt holes be exactly parallel. Formerly, a jig of the usual type was used for drilling these holes, but blow-holes and hard spots in the castings caused the drill to be deflected.

To overcome this difficulty, the jig shown in Fig. 1 was designed. In this jig, the holes are first rough-drilled and then finish-bored by means of the bar *E*, which is supported near each end of the drilled hole, thereby preventing any deflection of the bar. The bearing cap is centered on the stud *A*, which is secured in the cast-iron jig base *B*, and is leveled by means of the wedge *C*, which is driven in snugly between the face of the cap and the jig.

Both bolt holes are first rough-drilled, slip bushings (not shown) in the upper part of the jig being

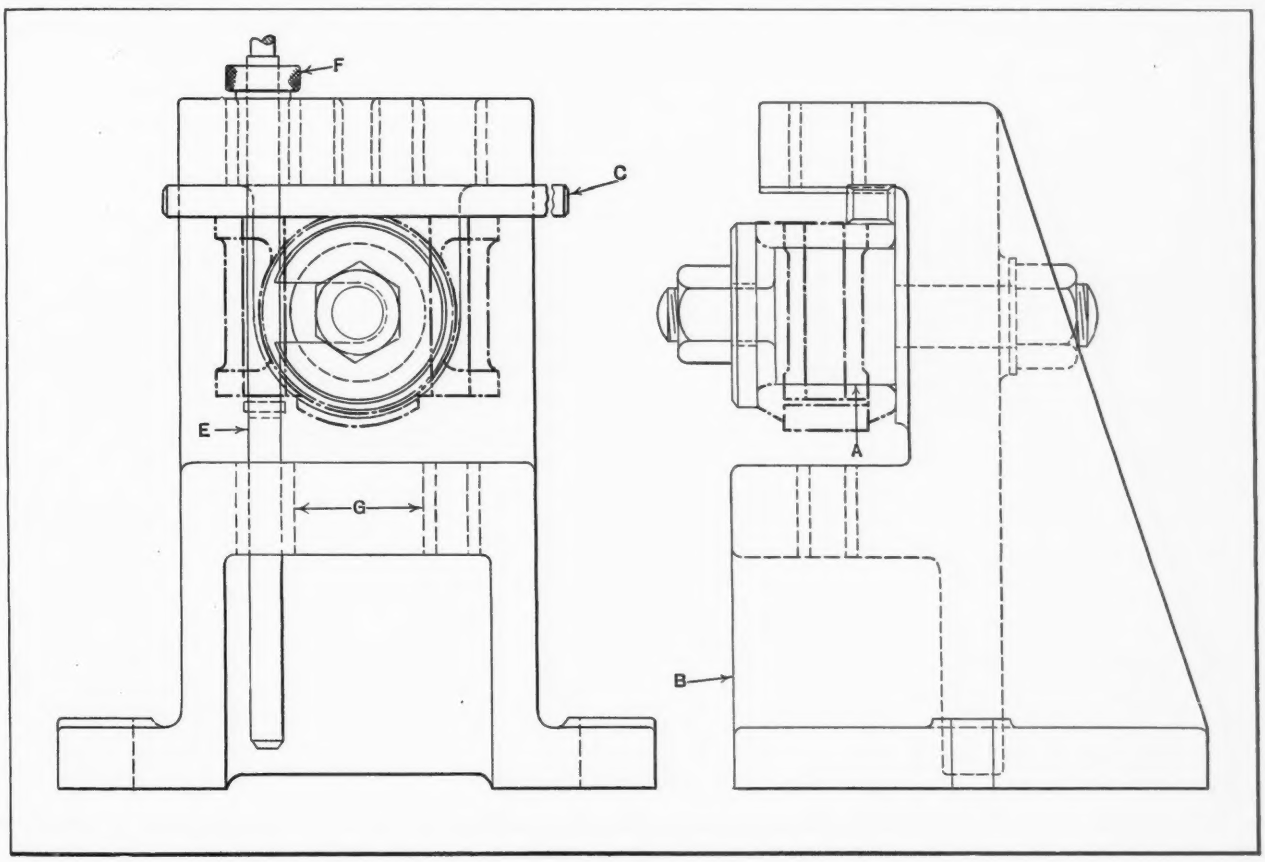


Fig. 1. In this Jig, the Boring-bar is Supported near Both Ends of the Hole

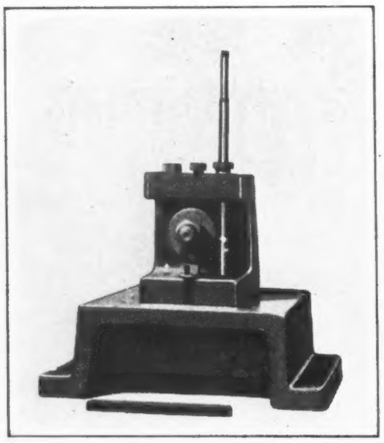


Fig. 2. Jig Designed on the Same Principle as One Shown in Fig. 1

used for guiding the drill. These bushings are then removed, and the boring-bar is passed through the drilled hole and down into one of the guide bushings *G*. The bushing *F* is now slipped over the shank of the bar and into the jig, and the hole is bored. It will be noted that the tapered shank of the bar is smaller than the body. This construction allows the slip bushing *F* to be removed without disturbing the cutter. The holes in both of the lower guide bushings are made with sharp edges in order to exclude the chips.

The floor-to-floor time for drilling and countersinking the oil-hole and drilling and boring the bolt holes in each piece is fifteen minutes. Another jig designed on the same principle as the one just described is shown in Fig. 2 with the boring-bar in its operating position.

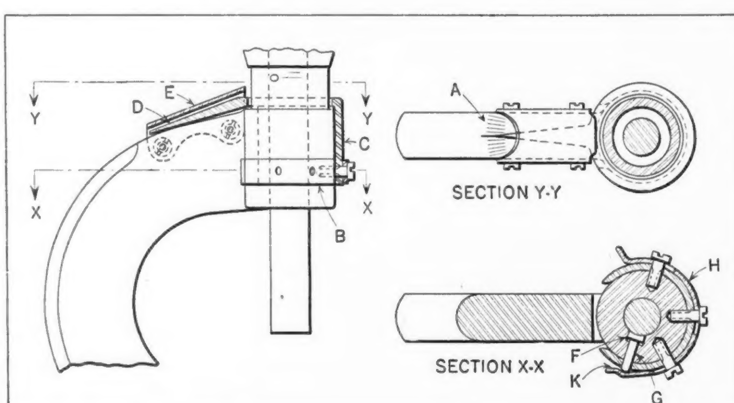
Indicator Attachment for Micrometers

By GEORGE J. MURDOCK, Newark, N. J.

In measuring a great number of parts with a vernier micrometer, a good deal of time is usually consumed in scrutinizing the vernier graduations. The writer has overcome this handicap by equipping a micrometer with an indicator that registers in ten-thousandths of an inch. It can be read rapidly and with the same accuracy as that of a vernier.

The attachment, which is shown in the illustration, adds little to the weight of the micrometer, and is neat and compact. It is especially adapted for measuring work between lathe centers, because the indicator is directly in line with the operator's vision.

The construction of the device is rather simple. It consists of the friction collar *B*, sleeve *C*, which carries the pointer *D*, and the pointer guard *E*. The regular knurled friction nut is replaced by the collar *B*, in which the spindle is a sliding fit. The sleeve *C* is secured to the collar by screws, and it is a slip fit over the boss of the frame. An opening is provided directly under the pointer, which is equal to the thickness of the U-portion of the frame plus the space necessary to allow the pointer to move over the ten graduations at *A*. Thus the movement of the pointer is limited by this opening.



Enlarged Drawing of Indicator Attachment for a Micrometer, which Facilitates Measuring to One-ten-thousandth Inch

A phosphor-bronze shoe *F*, backed up by the pin *G* and the spring *H*, provides the required friction between the collar and the spindle, so that when the spindle is turned, the pointer oscillates until one side of the opening in sleeve *C* comes into contact with the frame. The screws that secure the sleeve to the collar also serve to hold the spring in place. The screw holes in the spring are elongated so that the indicator can be disengaged. This is done by sliding the spring part way around the sleeve until the spring end *K* has released the pressure of the shoe against the spindle. The guard *E* simply protects the pointer from damage, and is secured to the frame by four watch screws.

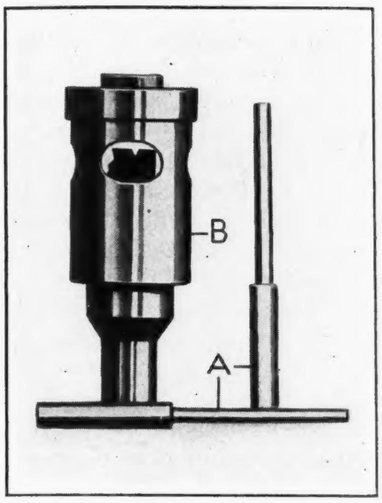
In measuring, the spindle is screwed down on the work in the same way as with a vernier. The spindle is then backed away until the micrometer can be removed from the work. While the spindle is being backed away, the pointer, through the friction of the shoe *F* against the spindle, moves over a number of graduations scribed on the frame. Each of these graduations represents one ten-thousandth inch, and to obtain the final reading, the number over which the pointer has passed must be added to or subtracted from the actual barrel reading, depending upon whether the graduations are read on the left- or the right-hand side of the pointer. Incidentally, when the spindle is being backed away, the pointer always starts from the same side of the micrometer.

As an example, suppose a diameter of, say, 1/4 inch is to be measured. First the spindle is screwed down gently on the part. Probably the direct reading on the barrel would be slightly less than 0.2510 inch. Now the spindle is backed away to the next one-thousandth graduation mark, and it is noted that the pointer has moved past four divisions. The final reading will therefore be 0.2510 — 0.0004 = 0.2506 inch.

Turning Slender Work in an Engine Lathe

By PAUL LEO, Elizabeth, N. J.

At one time the writer was confronted with the problem of providing tools for machining the pieces shown at *A* in the illustration. These parts were



Box-tool Used for Turning the Parts Shown

made of mild steel, 5/16 inch in diameter, and turned within very close limits to a diameter of 3/16 inch, the length of the turned part being 2 3/8 inches. The stock projected over 4 1/8 inches from the lathe chuck to permit cutting off the pieces. As these pieces had to be machined hurriedly, there was no time for making special tools.

The problem was solved, however, by making the tool shown. This tool consists chiefly of a standard hollow mill secured in a steel shank, and a work guide made from a drill bushing. The work guide was necessary, as the only lathe available produced inaccurate results and its construction did not permit the use of a follow- or steady-rest.

The outside diameter of the shank in which the hollow mill is secured is a close slip fit in the bushing *B*. In one end of this bushing is pressed a disk in which is accurately mounted the drill bushing. The diameter of the hole in this bushing is slightly larger than the outside diameter of the stock being turned.

In operation, the shank of the tool is secured in the tailstock of the lathe. While the tool is cutting, the drill bushing serves as a guide, holding the bar stock central with the hollow mill. It is obvious that no matter how long the diameter nor how slender the part being turned, this bushing will always keep the bar central with the hollow mill.

The shank in which the hollow mill is secured is drilled out to permit the part being turned to pass through. For this operation, the lathe spindle is run at the highest speed the mill will stand, and a heavy flow of cutting oil is passed through the holes provided in the side of the bushing *B* for cooling and for carrying off the chips.

Universal Piercing Dies Made of Standard Parts

By F. J. SANDERS, Dayton, Ohio

The piercing die here illustrated was designed and built by the Ohmer Fare Register Co., Dayton, Ohio, for piercing numerous small and accurate parts. It is composed entirely of standard parts, most of which can be purchased from companies that deal in diemakers' supplies. The purchased parts are the die-shoe *A*, stripper screws *B*, stripper springs *C*, piercing punch *D*, piercing die *E*, punch retainer *F*, die retainer *G*, punch backing plate *H*, dowels and screws.

The stripper plate *I*, the knock-out, stripper guide pins, and guide pin bushings are standard parts made by the Ohmer Fare Register Co. in large quantities and are kept in stock. Round, square or oval punches and dies can be purchased in any size, and are held in their retainers by a patented method which permits them to be removed without dismantling the die or removing it from the punch press.

To equip a die for piercing a part, one of the standard stripper plates is first drawn from stock and drilled for the stripper screw and guide pins. A master plate is used for this work, so that all parts will be interchangeable. The clearance hole for the piercing punch is next drilled or filed to size, depending on the shape of the punch. The stripper screw holes and the die spring holes are then counterbored to the proper depth, and all parts assembled in place.

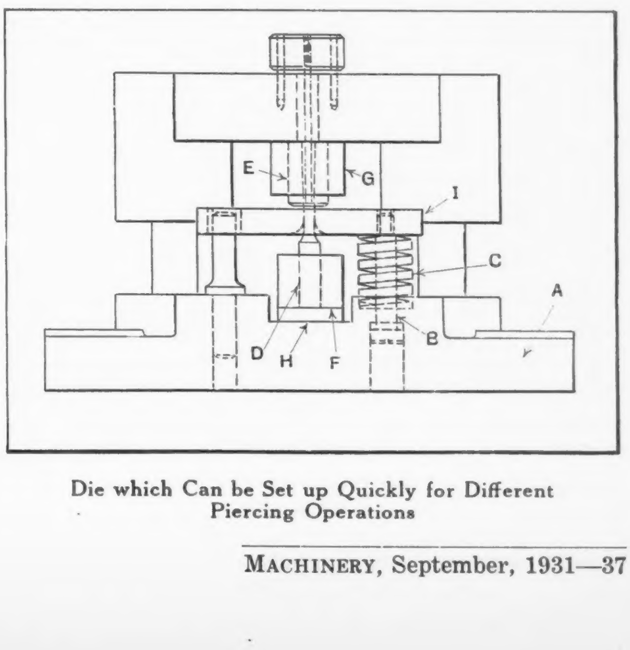
The nest or locating plates for locating the blank to be pierced are now filed to shape and secured in place with screws. These plates are made of cold-rolled steel and are somewhat thinner than the blank to be pierced. After a few trial blanks have been pierced to see that the nest plates are properly located, the plates are secured by dowels.

All removable parts are stamped with the proper piece number and tool number and are kept in the tool-crib when not in use. In addition to being accurate and easy to change for different parts, a die of this type represents a good investment, when the cost of assembling the few standard parts is compared with the cost of building an entirely new die.

Spindle Attachment for Indicating Punch Marks

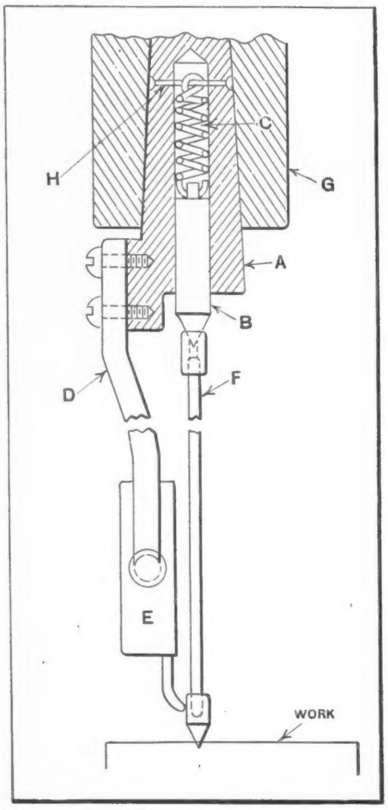
By DANIEL GERRILD, Chicago, Ill.

The attachment shown in the accompanying illustration is designed for indicating small prick-punch marks previous to drilling and boring in order to



Die which Can be Set up Quickly for Different Piercing Operations

insure accurate alignment of the spindle with the punch mark. The device consists of a holder *A* which fits into the machine spindle and is bored and reamed for a plunger *B*. The plunger is held in position by a small compression spring *C*, which is kept from falling out by a pin *H* passing through the holder *A*.



Indicator Used in Drilling Machine Spindle for Locating Punch Mark

To holder *A* is attached a bar *D*, on the end of which an indicator *E* is mounted. A rod *F*, having a center hole in one end and a conical center at the other, is placed between plunger *B* and the work with the conical point in the prick-punch mark. The indicator *E* is brought into contact with the rod *F* as near the work as possible. Next, the spindle is revolved by hand. The amount the prick-punch mark is out of line with the spindle is then clearly shown by the indicator and corrections made.

Rod *F* is held against the work by the compression spring *C*, as the friction developed by the center in the punch mark is very slight and insufficient to overcome the driving friction between the indicator contact and rod *F*. The body of holder *A* may be made straight instead of tapered, so that it can be held in a drill chuck. The device has been found particularly useful on milling machines for locating holes quickly where extreme accuracy is not required. However, it is capable of holding the work within limits of 0.001 inch.

Graduating Fixture Provided with Interchangeable Stamps

By I. F. YEOMAN, Elkhart, Ind.

The fixture illustrated in Figs. 1 and 2 is used for stamping graduation marks on twenty-seven different sizes of collars ranging from 5/8 to 2 7/8 inches in diameter. On some, forty graduation marks are required around the circumference, while on others only twenty are needed. The length and style of the lines used for this work may be varied by using different stamps.

In Fig. 2 is shown the construction of the fixture. The cast-iron disk *A* has forty grooves milled around its circumference, and over this disk is pressed a steel ring *B*, thus forming forty holes of nearly square cross-section. As the inside diameter of the ring is 6 inches, the curvature forming one side of each of the holes is so slight that it may be disregarded. A 1/4-inch hole is drilled through the ring and through the center of each groove a short distance into the cast-iron disk *A*.

In each of the square holes is mounted a stamp which is held in place by a small coil spring, as shown at *C*. The disk *A* is a slip fit over the circular projection *E* on the block *D*. This block is bored and counterbored to receive the sleeve *F* upon which is securely mounted the miter gear *G*. Gear *G* meshes with a similar gear secured to disk *A*. Hence, it is obvious that for every revolution of the disk, a movement of one revolution will also be imparted to sleeve *F*.

The work is held on an arbor secured in this sleeve, the arbor being shown in place with a collar to be graduated secured to one end. The hand-screw *J* serves to lock the collar to the arbor. Directly over the work is a plunger *L*, carried in a hardened sleeve *M*. This sleeve can be adjusted to limit the vertical movement of the plunger by screwing it up or down to suit the depth of the graduation marks. A light tap of a lead hammer on the end of the plunger is required to stamp each line on the work.

The fixture is indexed by means of the hand-lever *R*. As shown, the lever is in position for rotating the disk *A* one division. The pawl engages one

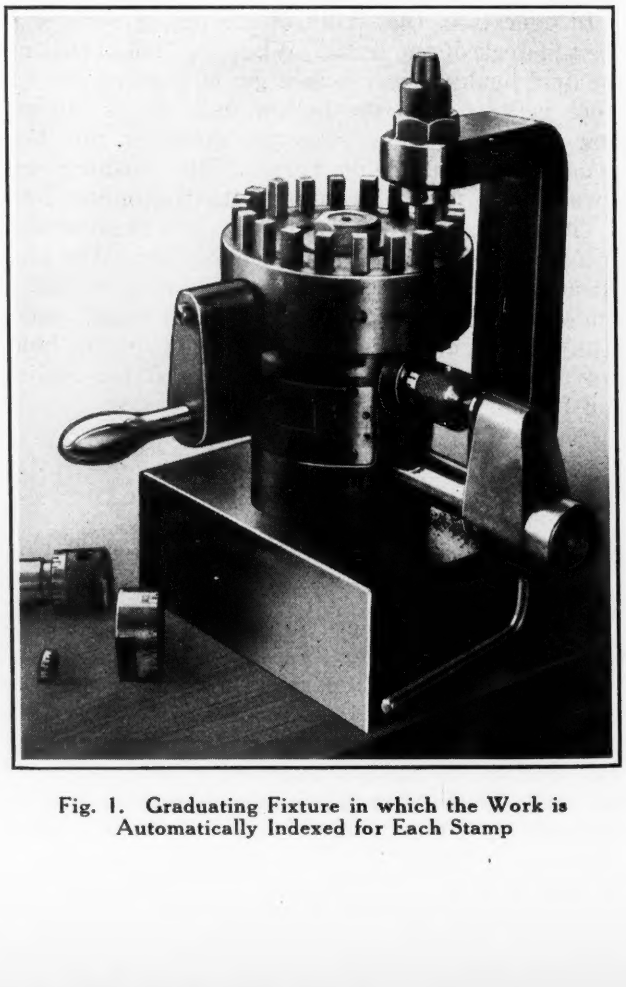


Fig. 1. Graduating Fixture in which the Work is Automatically Indexed for Each Stamp

of the 1/4-inch holes drilled through the outer steel ring, thus locking the disk to the lever. By swinging the lever to the right until it comes in contact with stop *S*, another stamp will be moved over the work by the disk, and at the same time the work will be revolved an amount corresponding to one graduation. At this time, the spherical end of the pin *Y* engages a corresponding depression in the under side of the disk and holds it firmly in position, so that the lever can be brought back to engage the next hole in ring *B*.

The average production on this operation is forty graduations per minute. The fixture can be used for a smaller number of graduations by omitting the stamps not needed. To graduate parts to an odd number of divisions, a suitable stamp head similar to that shown at *A* must be provided. The cost of maintaining the fixture is very small, as the replacement of stamps due to wear or breakage may be done with little expense.

* * *

Why Not be Accurate?

In perusing the pages of technical journals, as well as in daily conversation, one cannot help noting many unnecessary inaccuracies. One writer recently mentioned the "tin" coating on "galvanized" gears; another described a device for skimming the oxides from the top of the molten "lead" in a "galvanizing" vessel. When terneplate is fabricated into a roof it is spoken of as a "tin" roof, and it is not uncommon for an article made of thin sheet steel, entirely devoid of tin, to be called a "tin" article.

* * *

Does the Machine Cause Unemployment?

The expression "technological unemployment" has become very popular of late and is a great favorite with people who like to speak critically of our present industrial methods. The idea is that fewer and fewer people are employed in the industries because of the use of machinery. As a matter of fact, more and more people are constantly being employed in the industries as compared with the number so employed when machinery was used to a much more limited extent.

Statistics show that in the earlier days of industrial employment in the United States—that is, eighty years ago—one person in every twenty-three was employed in industrial work. In 1925, one person in every eleven was employed in industrial plants, on the railroads, or in communication service. Hence, for every thousand inhabitants, there are more than twice as many people employed in industry in normal times as there were in the early days of the machine age; in other words, the increase in the use of machinery has more than doubled the opportunity for each individual for employment in industrial work.

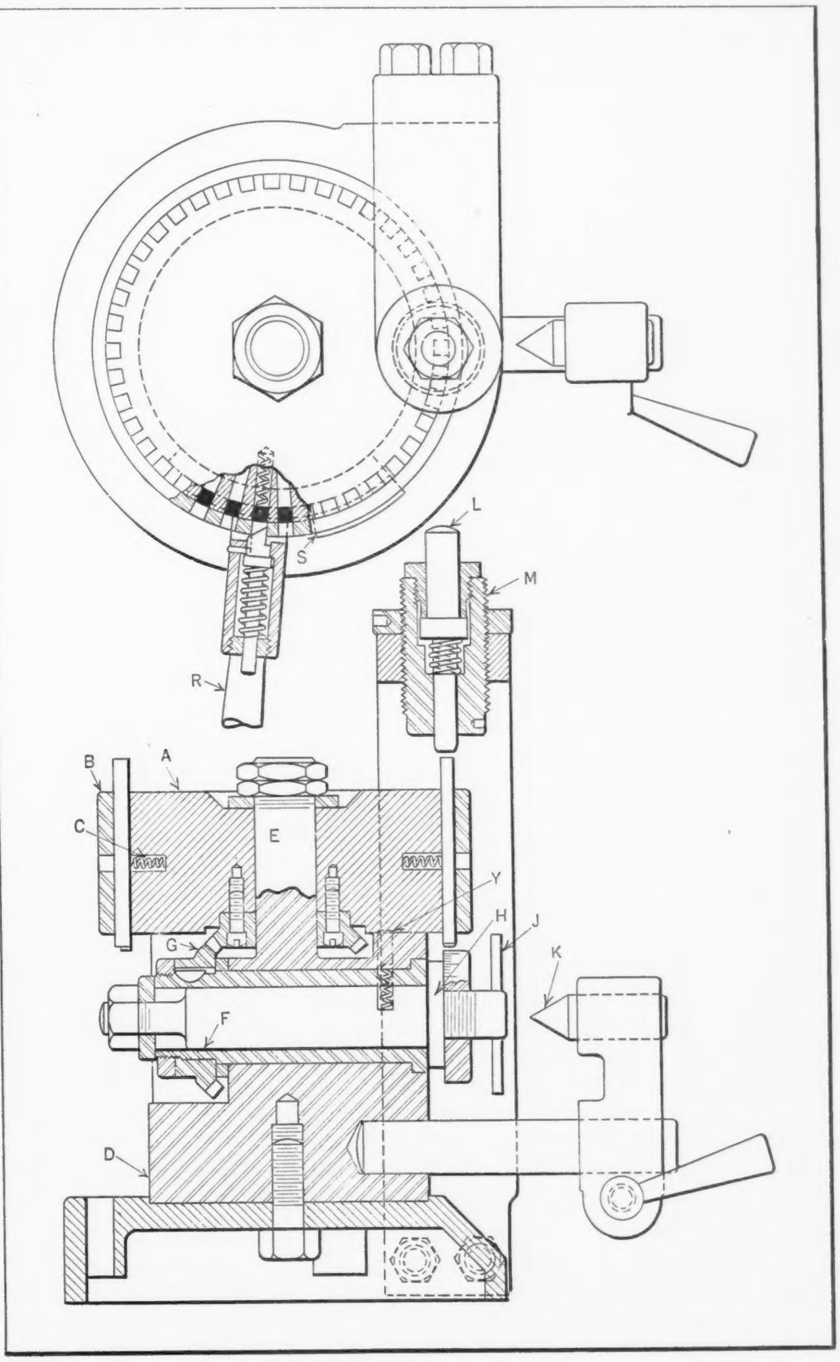


Fig. 2. Construction of Graduating Fixture Shown in Fig. 1

Are Apprentices Steady Workers?

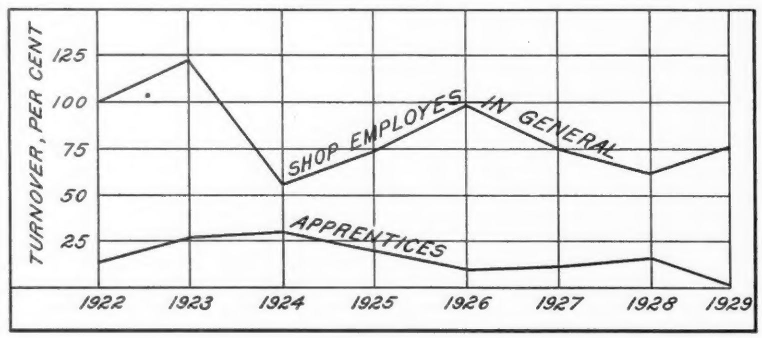
A Large Corporation with a Highly Developed Apprentice System Finds the Labor Turnover among Apprentices Much Smaller than among Shop Employes in General

By C. J. FREUND, Apprentice Supervisor
The Falk Corporation, Milwaukee, Wis.

IN many ways it is more disappointing when an apprentice leaves than when a regular employe quits. In fact, it is a severe disappointment to a shop executive or foreman to be told that an apprentice has suddenly decided not to finish his course. This is easily appreciated when we recognize that the foreman or other shop supervisor has devoted much time and attention to the apprentice; has shown him carefully how to do the work required of him, and taught him much that, perhaps, was not really called for by the terms of the apprentice agreement; has answered hundreds of the boy's questions and set him right when jobs have been started wrong; and has excused scrap and accidental damage to tools and equipment. As a result of all this effort, the boy has begun to show signs of development, and naturally, it is a keen disappointment to have a boy leave at this stage of his training.

Because an apprentice occasionally leaves, many foremen and shop supervisors take the attitude that the time and attention given to apprenticeship is largely wasted and that apprentice training is not worth while. One could not blame them for taking this attitude if the majority of apprentices were inclined to leave. Recorded facts indicate, however, that this is not the case; but the few boys that leave stand out more clearly in the foreman's mind than two dozen steady apprentices.

It has been known to happen that the foremen in a plant have investigated the turnover of apprentices in order to determine whether it would be advisable to abolish the apprentice system because of the unsteadiness of the boys, and have found, to their surprise, that the apprentices are less likely to change their jobs than other classes of employes. In the plant of the Falk Corporation, Milwaukee, Wis., a comparison has been made between the annual turnover percentage of apprentices and all other employes, during the period from 1922 to 1929, inclusive. The highest annual turnover percentage among apprentices occurred in 1924, when the figure reached 30 per cent. It so happens that in that year the percentage of turnover among all other employes was the lowest, or a little under 60 per cent. Hence, the lowest general turnover is practically double that of the highest apprentice turnover. In all other years of the period considered, the difference is still greater and in 1929, when the percentage of turnover of apprentices was only 3 per cent, the general turnover was over 75 per cent.



A Comparison of the Labor Turnover in a Large Plant over a Number of Years, Showing the Small Percentage for Apprentices Contrasted with Shop Employes in General

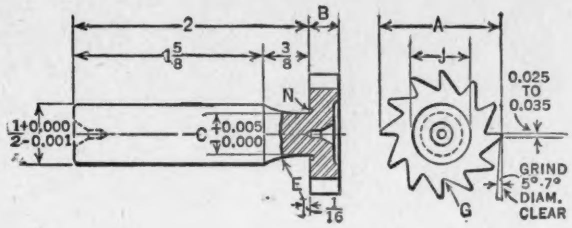
Apprentices are on probation during the first three months of their course, after which the regular apprentice agreement becomes effective. The probationers are not included in the comparison, because if a probationer leaves, it is generally sufficient evidence that he is not suitable for the trade, and it is an advantage, rather than otherwise, to have him leave. It is obvious, of course, that the formal indenture or agreement of apprenticeship, signed by the employer, the parents, and the apprentice himself, is an important factor in securing stability of apprentice employment, and such an agreement should be considered an essential part of every apprenticeship system.

* * *

In 1930, the automobile plants in the United States, not including manufacturers of parts, accessories, bodies or tires, employed 325,000 people and paid $647,600,000 in wages. Altogether, 4,152,000 people were directly employed through the automobile industry. Of these, 170,000 worked in parts and accessory factories, and 65,000 in tire plants; 380,000 were employed in garages and repair shops, and 2,750,000 as chauffeurs and truck drivers. In addition, 450,000 people were engaged in selling and distribution. This does not account for another million people employed in the production of gasoline and in making the raw materials from which automobiles are built, or those engaged in the building of highways which would not have been called for except because of the automobile.

WOODRUFF KEYSLOT CUTTER DIMENSIONS—1

Approved by American Standards Association, December, 1930



All dimensions in inches

Both ends of the shank shall be drilled and countersunk with a 60-degree angle in accordance with this table.

Key Number	Maximum Countersink Diameter	Drill Diameter	Depth of Drilled Hole below Countersink
402	3/32	1/16	1/16
403 to 708	1/8	1/16	1/16
806 to 1212	3/16	3/32	3/32

Key Number*	Nominal Key Size	Number of Teeth		Cutter Diameter† A		Cutter Width‡ B		Neck Diameter	Radii			Recess Diam.
		Fine	Coarse	Max.	Min.	Max.	Min.	C	E	G	N	J
204	1/16 x 1/2	10	8	0.515	0.510	0.0625	0.0620	0.130	23/64	1/64	1/64	1/4
304	3/32 x 1/2	10	8	0.515	0.510	0.0938	0.0933	0.160	3/8	1/64	1/64	1/4
305	3/32 x 5/8	10	8	0.640	0.635	0.0938	0.0933	0.191	13/32	1/32	1/64	5/16
404	1/8 x 1/2	10	8	0.515	0.510	0.1250	0.1245	0.191	13/32	1/32	1/64	1/4
405	1/8 x 5/8	10	8	0.640	0.635	0.1250	0.1245	0.223	7/16	1/32	1/64	5/16
406	1/8 x 3/4	10	8	0.765	0.760	0.1250	0.1245	0.217	13/32	1/32	1/64	3/8
505	5/32 x 5/8	10	8	0.640	0.635	0.1563	0.1558	0.253	15/32	1/32	1/64	5/16
506	5/32 x 3/4	10	8	0.765	0.760	0.1563	0.1558	0.247	7/16	1/32	1/64	3/8
507	5/32 x 7/8	12	9	0.892	0.887	0.1563	0.1558	0.247	7/16	1/32	1/64	7/16
606	3/16 x 3/4	10	8	0.765	0.760	0.1873	0.1868	0.279	1/2	1/32	1/64	3/8
607	3/16 x 7/8	12	9	0.892	0.887	0.1873	0.1868	0.279	1/2	1/32	1/64	7/16
608	3/16 x 1	12	10	1.017	1.012	0.1873	0.1868	0.279	1/2	1/32	1/64	1/2
609	3/16 x 1 1/8	12	10	1.142	1.137	0.1873	0.1868	0.312	9/16	1/32	1/64	9/16

*For this and all other notes, see Data Sheet No. 210.

MACHINERY'S Data Sheet No. 209, New Series, September, 1931

WOODRUFF KEYSLOT CUTTER DIMENSIONS—2

Approved by American Standards Association, December, 1930

Both the fine- and coarse-tooth keyslot cutters are of the shank type having a shank diameter of 1/2 inch. A back clearance of 0.006 to 0.010 inch per inch (20 to 40 minutes of arc) shall be ground on each side of the cutter, and each side face may be recessed to a depth of not more than one-fourth of the cutter width.

The cutting edges of the teeth shall be ground concentric within 0.002 inch, and both sides shall be parallel within 0.0005 inch according to the indicator reading. In order that the cutters may be centered accurately for regrinding, provision for which has been made in the maximum dimensions, both ends of the shank shall be drilled and countersunk with a 60-degree angle in accordance with the figures given in Data Sheet No. 209. All cutters shall be marked on the shank with the key number or nominal size and the maker's name or trademark. All dimensions given in the table are in inches.

Key Number*	Nominal Key Size	Number of Teeth		Cutter Diameter† A		Cutter Width‡ B		Neck Diameter	Radii				Recess Diam.
		Fine	Coarse	Max.	Min.	Max.	Min.	C	E	E¶	G	N	J
807	1/4 x 7/8	12	9	0.892	0.887	0.2497	0.2492	0.342	21/32	.....	1/32	1/64	7/16
808	1/4 x 1	12	10	1.017	1.012	0.2497	0.2492	0.342	21/32	.....	1/32	1/64	1/2
809	1/4 x 1 1/8	12	10	1.142	1.137	0.2497	0.2492	0.373	3/4	.....	1/32	1/64	9/16
810	1/4 x 1 1/4	14	10	1.270	1.265	0.2497	0.2492	0.373	3/4	.....	1/32	1/64	5/8
811	1/4 x 1 3/8	14	10	1.395	1.390	0.2497	0.2492	0.401	.....	3/64	1/32	1/32	11/16
812	1/4 x 1 1/2	16	12	1.520	1.515	0.2497	0.2492	0.435	.....	1/32	1/32	1/32	3/4
1008	5/16 x 1	12	10	1.017	1.012	0.3121	0.3116	0.401	.....	3/64	1/32	1/32	1/2
1009	5/16 x 1 1/8	12	10	1.142	1.137	0.3121	0.3116	0.435	.....	1/32	1/32	1/32	9/16
1010	5/16 x 1 1/4	14	10	1.270	1.265	0.3121	0.3116	0.435	.....	1/32	1/32	1/32	5/8
1011	5/16 x 1 3/8	14	10	1.395	1.390	0.3121	0.3116	0.467	.....	1/64	1/32	1/32	11/16
1012	5/16 x 1 1/2	16	12	1.520	1.515	0.3121	0.3116	0.467	.....	1/64	1/32	1/32	3/4
1210	3/8 x 1 1/4	14	10	1.270	1.265	0.3745	0.3740	0.467	.....	1/64	1/32	1/32	5/8
1211	3/8 x 1 3/8	14	10	1.395	1.390	0.3745	0.3740	0.467	.....	1/64	1/32	1/32	11/16
1212	3/8 x 1 1/2	16	12	1.520	1.515	0.3745	0.3740	0.467	.....	1/64	1/32	1/32	3/4

For smaller size cutters and illustration see Data Sheet No. 209.

*Key numbers indicate the nominal key dimensions. The last two digits give the nominal diameter *B* in eighths of an inch, and the digits preceding the last two give the nominal width *A* in thirty-seconds of an inch. Thus, 204 indicates a key 2/32 × 4/8 or 1/16 × 1/2 inch; 1210 indicates a key 3/8 × 1 1/4 inches.

†Maximum diameters permit regrinding cutters once or twice.

‡The minimum cutter width is equal to the minimum keyslot width plus 0.0005 inch. (See Data Sheet 208, August, 1931.) The width of the keyslot cut by the maximum cutter will be found in the majority of cases to be slightly less than the maximum keyslot width given in Data Sheet 208.

¶For keys larger than No. 810, cutters with cylindrical necks are specified, *E* being the radius between the neck and shank.

MACHINERY'S Data Sheet No. 210, New Series, September, 1931

Finding Gear Ratios by Continued Fractions

Simplified Method of Using Continued Fractions to Determine the Number of Teeth Required in Change-Gears to Give the Desired Ratio

By JAMES L. INGALLS

CHANGE-GEAR calculations for cutting threads and spirals, and for differential indexing, are always based on a fraction that indicates the gear ratio between the driving and driven gears. In many instances, the numerator and denominator of this fraction are much larger than any gear tooth numbers available. It is then necessary to find the fraction most closely approximating the exact fraction but having a numerator and denominator that come within the range of gear tooth numbers available.

By the use of continued fractions as described in this article, a series of fractions can be found in which each succeeding fraction approaches more closely the exact or given fraction. From this series of fractions, it is a simple matter to obtain the required gears.

The lead of a spiral, for example, may be given as a mixed number or a decimal, but in each case it must be changed to the form of a fraction. When the numerator and the denominator of the lead fraction are too large for any change-gears on hand and cannot be reduced by factoring, as in the case of $\frac{211}{359}$, we can use continued fractions to obtain other fractions of closely approximate values that can be used in place of the given lead fraction. Both numerator and denominator of the fraction $\frac{211}{359}$ are too large and are also prime numbers. We will therefore apply continued fractions to obtain a fraction of approximately the same value that is within the range of the available gears.

Application of Continued Fractions

The method of applying continued fractions for this purpose will be described step by step in the following paragraphs:

Step 1—Divide the denominator 359 by the numerator 211 and continue dividing until the remainder is less than the divisor.

Step 2—Divide the divisor 211 by the remainder 148 and continue dividing until the remainder is less than the last divisor. Continue this process of dividing each divisor by its remainder until the remainder is 0.

Steps 1 and 2 are carried out as follows:

```
211)359(1..........................First P. Q.
    211
     148)211(1...................Second P. Q.
         148
          63)148(2................Third P. Q.
             126
              22)63(2............Fourth P. Q.
                 44
                 19)22(1...........Fifth P. Q.
                    19
                     3)19(6........Sixth P. Q.
                       18
                        1)3(3.... Seventh P. Q.
                          3
                          0
```

Step 3—The quotients thus obtained are known as partial quotients, and from now on will be referred to as P. Q. Now arrange these P. Q.'s 1, 1, 2, 2, 1, 6, 3 in a horizontal line beginning at the left with the first P. Q., as shown in the upper line in the accompanying illustration. We will now derive a set of fractions from these P. Q.'s. The first fraction will be put under the first P. Q., the second fraction under the second P. Q., and so on to the end, as shown in the illustration, proceeding as described in the following steps:

Step 4—The numerator of the first fraction will always be 1. The denominator of the first fraction will always be the first P. Q., so that in this case the first fraction is $\frac{1}{1}$.

Step 5—The numerator of the second fraction will always be the second P. Q. The denominator

	First P.Q.	Second P.Q.	Third P.Q.	Fourth P.Q.	Fifth P.Q.	Sixth P.Q.	Seventh P.Q.
	1	1	2	2	1	6	3
Derived Fractions	$\frac{1}{1}$ ← + —	$\frac{1}{2}$	$=\frac{3}{5}$	$\frac{7}{12}$ ← + —	$\frac{10}{17}$	$=\frac{67}{114}$	$\frac{211}{359}$

Method of Deriving Series of Gear Ratio Fractions from Partial Quotients

of the second fraction will be found by multiplying the first P. Q. by the second P. Q. and adding 1, so that the second fraction is $\frac{1}{2}$.

Step 6—The numerator of the third fraction will be found by multiplying the third P. Q. by the numerator of the first preceding fraction and adding the numerator of the second preceding fraction, as $2 \times 1 + 1 = 3$. The denominator of the third fraction will be found by multiplying the third P. Q. by the denominator of the first preceding fraction and adding the denominator of the second preceding fraction, as $2 \times 2 + 1 = 5$. Thus for the third fraction we have $\frac{3}{5}$.

Note: Step 6 is illustrated graphically by the use of lines, arrow heads, and multiplication and addition signs. The method of obtaining the sixth fraction is also illustrated in the same manner.

Step 7—All fractions after the second will be found by the same method as is used for finding the third fraction. Thus, the fourth fraction is

$\frac{2 \times 3 + 1}{2 \times 5 + 2} = \frac{7}{12}$; the fifth, $\frac{1 \times 7 + 3}{1 \times 12 + 5} = \frac{10}{17}$;

the sixth, $\frac{6 \times 10 + 7}{6 \times 17 + 12} = \frac{67}{114}$; and the seventh,

$\frac{3 \times 67 + 10}{3 \times 114 + 17} = \frac{211}{359}$.

Note: If the original or lead fraction is reduced to its lowest terms before using continued fractions, the last derived fraction will always be the original or lead fraction. This furnishes the calculator with a reliable check on his work. It is also seen that the value of these derived fractions gets closer to the value of the original lead fraction as we go from the first fraction on up. Thus, the fifth is more accurate than the fourth, the sixth is more accurate than the fifth, etc.

In selecting a fraction, we must reduce both the original lead fraction and the selected derived fraction to a decimal form for comparison.

As the original lead fraction $\frac{211}{359} = 0.587743+$ and the derived fraction $\frac{67}{114} = 0.587710+$, we have an error of 0.000033, which would probably be a permissible error.

If the lead is given in the form of a mixed number, as $2\frac{17}{157}$, this should be reduced to a fraction, as $\frac{331}{157}$, to see if it can be used as it stands. If it cannot, the fractional part of the mixed number, $\frac{17}{157}$, should be used, and other fractions derived from it by using continued fractions as described, being careful to have the fraction in its lowest terms before dividing, to avail ourselves of the mathematical check. After selecting $\frac{4}{37}$ from the derived fractions, we add it to the whole number, as $2\frac{4}{37}$ and reduce to the fraction $\frac{78}{37}$.

For comparison, reduce both the original lead fraction and the new fraction to decimals. The original lead fraction $\frac{331}{157} = 2.1082+$, while the new fraction $\frac{78}{37} = 2.1081+$, giving an error of 0.0001.

If the lead is given in decimal form and is, say, 0.9203, we express it as a fraction, or $\frac{9203}{10000}$, and after making sure that it is in its lowest terms, proceed to derive other fractions from it as described.

One should not admit defeat if the first few trials fail to give a usable fraction, for the writer has often seen a calculator work for hours to get a suitable set of change-gears, especially when they were to be used for cutting spiral flutes in milling hobs, which have to be very accurate. If the first set of derived fractions does not suit, we may change the decimal value of the original or lead fraction, within allowable limits of error, and start again. Thus:

0.9833 gives derived fractions of $\frac{1}{1}, \frac{58}{59}, \frac{59}{60}, \frac{447}{479}, \frac{1001}{1018}, \frac{1472}{1497}, \frac{9833}{10000}$ and 0.9831 gives derived fractions of $\frac{1}{1}, \frac{58}{59}, \frac{291}{296}, \frac{349}{355}, \frac{1687}{1716}, \frac{2036}{2071}, \frac{9831}{10000}$.

Thus, by changing the lead 0.0002, we can get a new set of fractions, as shown. After the calculator has become accustomed to this work, he will probably see other possible changes for getting new fractions.

* * *

The Simonds' Annual Economic Contest

In the ninth annual economic contest, for which Alvan T. Simonds, president of Simonds Saw & Steel Co., Fitchburg, Mass., awards the prizes, the first prize of $1000 was awarded to C. E. R. Sherrington, formerly instructor in economics at Cornell University and now lecturer in transport at the London School of Economics and Political Science. The second prize, $500, was awarded to Frederick Geidt of 97 Gresham St., London, England. The subject of the contest was "Government Interference with the Free Play of Economic Forces." The contest was open to anyone throughout the world who wished to submit a treatise on the subject.

Burring Attachment for Automatic Screw Machine

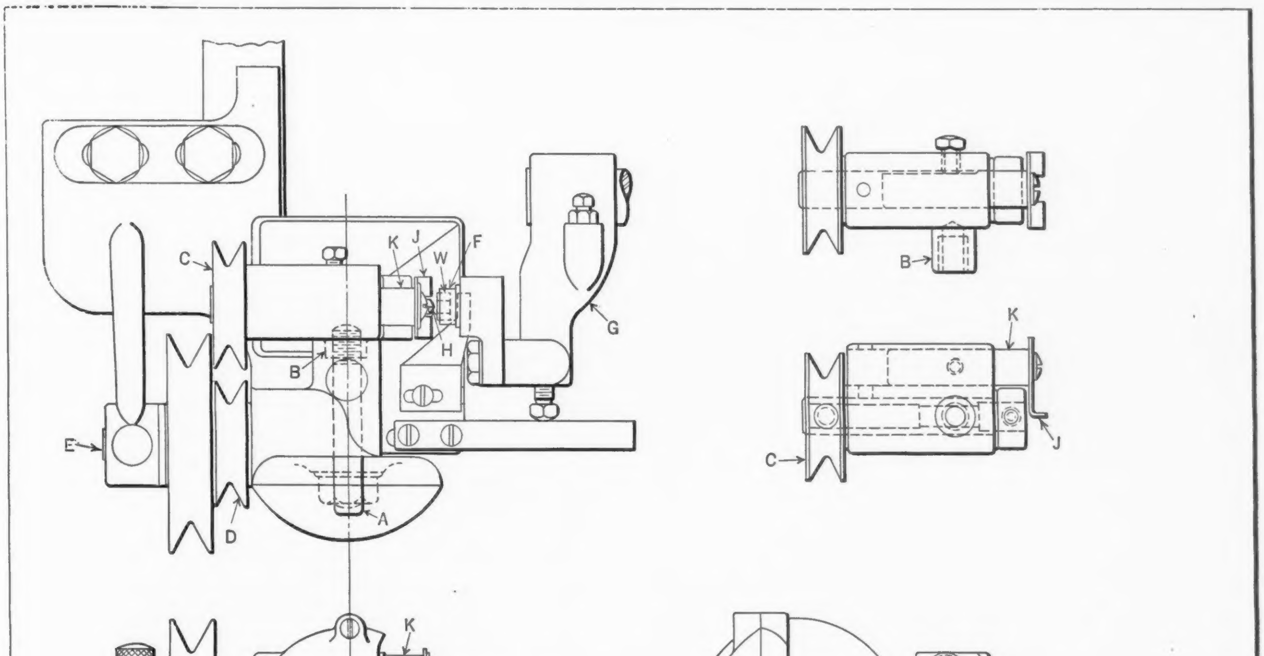
By HAROLD P. BERRY and SAMUEL O. SHUMACKER

The accompanying illustration shows how a screw-slotting attachment for a Brown & Sharpe automatic screw machine was equipped with a revolving drill for removing the burr left on the rear face of the work by the cutting-off tool. The revolving drill-holder unit provided to replace part of the standard slotting equipment is shown in the upper right-hand corner of the illustration. The drill-holder unit is clamped in place by bolt *A*, which is threaded to fit the tapped hole in boss *B*. The drill spindle is provided with a V-groove pulley *C*, which is driven from the pulley *D* mounted on shaft *E* of the attachment.

When the work *W* is cut off, it is received by the bushing *F*, in which it is a slip fit. As soon as the cut off piece is in the bushing *F*, the arm *G*, on which the bushing *F* is mounted, automatically swings into the position shown in the illustration. The arm then advances automatically toward the drill *H*, causing the work to come into contact with the spring tension fingers *J*, which prevent it from revolving while the drill performs the burring operation. Stud *K* on which the spring fingers *J* are mounted can be adjusted so that the fingers will exert just sufficient tension on the work to prevent rotation.

* * *

Micarta has given exceptional service as a bearing liner in wire, rod, and bar mills, according to the Westinghouse Electric & Mfg. Co., manufacturer of this material. Representative installations, where the pressures are not excessive and the peripheral speeds vary from 100 to 1000 feet per minute, have shown this material to be unusually well suited for roll neck service. Water alone is used as a lubricant. Impure water, containing weak acids or alkalis, has no effect on the Micarta lining. Seizing is eliminated due to the non-absorbing and non-warping qualities of Micarta, and scoring is reduced to a minimum.



Screw-slotting Attachment of B & S Automatic, Adapted for Burring Operation on Rear End of Work

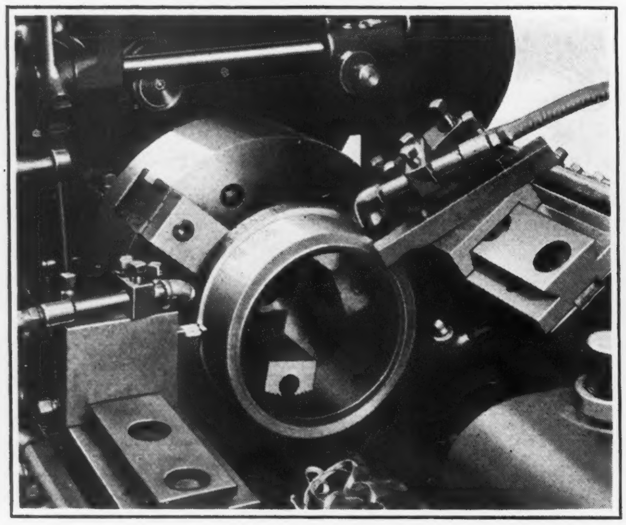


Fig. 1. Removing Sixteen and a half Pounds of Metal from Nut Forging in Three Minutes

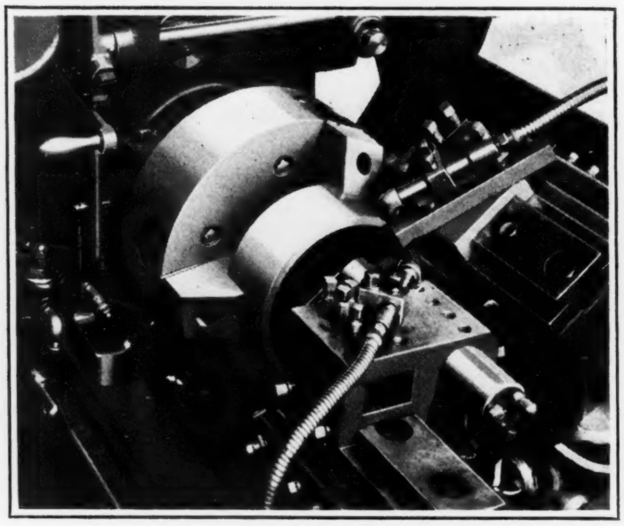


Fig. 2. Rough-boring and Rough-facing in Second Operation on an Automatic Lathe

Machining Large Ring-Type Adjusting Nuts

Care in Planning Sequence of Operations and Choice of Right Machine Tool for Each Operation Produces Excellent Results

By H. T. LAFFIN
Jones & Lamson Machine Co., Springfield, Vt.

THE ring-type adjusting nut shown nearing completion at *A*, Fig. 6, is used on the Fay automatic lathe made by the Jones & Lamson Machine Co., Springfield, Vt. It serves to adjust the thrust bearing of the spindle. The hobbed teeth around the outer edge and the slots around the rim provide means for adjusting and locking the nut in place. The nut is machined from a rough forging weighing 26 1/2 pounds. It is 8 1/2 inches in diameter and 3 1/2 inches wide. The inside is bored out to a diameter of 7.850 inches by 2 1/2 inches deep, while the threaded portion is bored to a diameter of 7.275 inches for a length of 3/4 inch.

The first two operations are performed on Fay automatic lathes, with one man running two machines. In these operations, the forgings are completely rough-turned and bored and both ends are

Fig. 3. Finish-facing, Finish-boring, and Threading on Turret Lathe at One Chucking

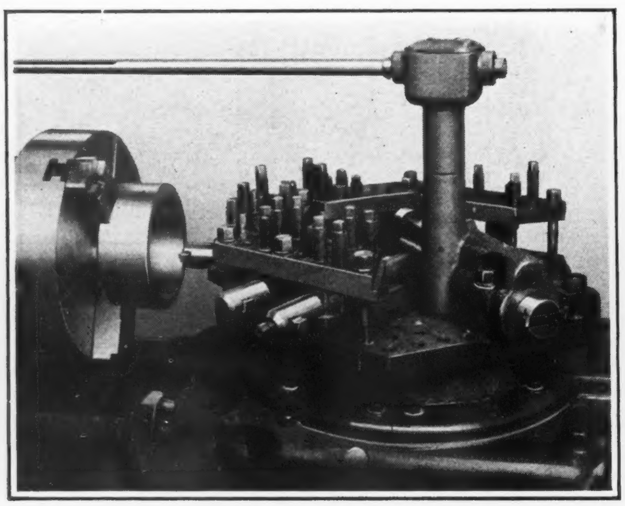
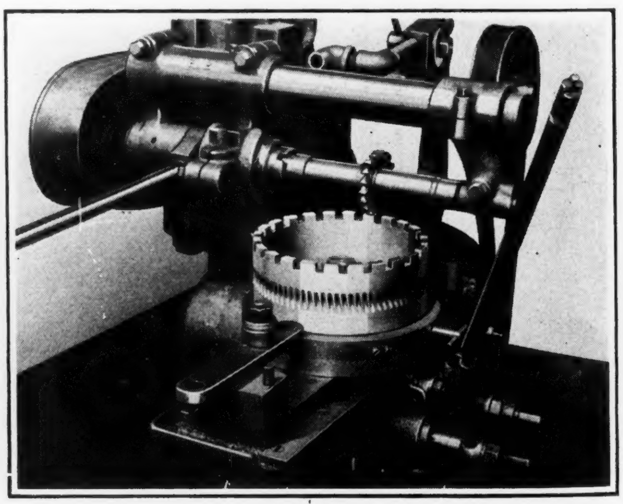


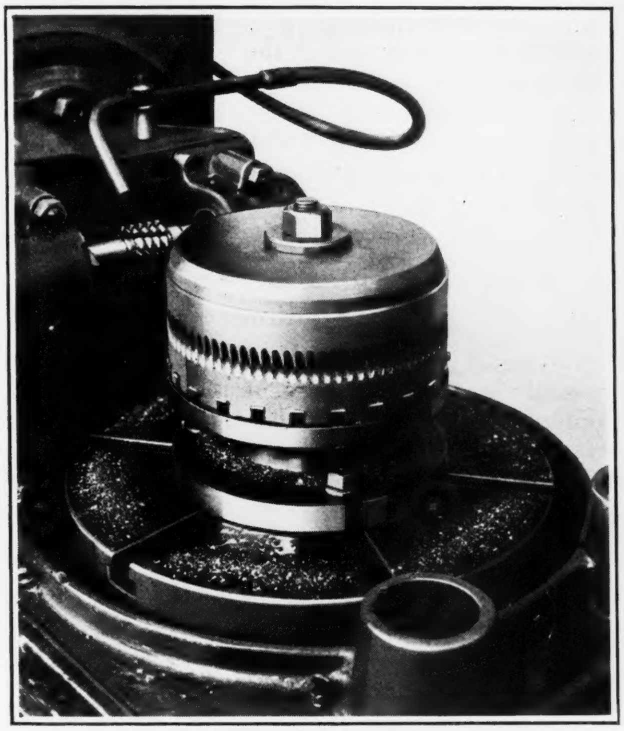
Fig. 4. Cutting Slots in Rim on a Hand Milling Machine Having an Indexing Fixture



faced. During the first operation 16 1/2 pounds of metal are removed in three minutes cutting time, the weight of the forging being reduced to 10 pounds. For this operation, the forging is chucked on the inside, as illustrated in Fig. 1, while the outside diameter is turned and the end faced. For the second operation, the piece is chucked on the outside, as shown in Fig. 2, while the inside is rough-bored and rough-faced.

In the third operation, the piece is chucked in a Jones & Lamson turret lathe, as shown in Fig. 3, where it is finish-faced, finish-bored, and threaded on the inside. By employing the thread chasing attachment, the finish-boring and finish-facing operations can be performed with the work held in the same chucking position as for threading. This insures a face and bore that are true with the thread.

Fig. 5. Hobbing Teeth on Adjusting Nut with Machine Equipped with Special Fixture



The fourth operation consists of cutting the slots on the outer edge of the work, using a hand milling machine equipped with a twenty-four-position indexing fixture, as shown in Fig. 4.

After the slots are milled on the outer edge, the pieces are held on a special fixture, mounted on the hobbing machine shown in Fig. 5, for hobbing the teeth around the outer surface. The sixth and final machining operation consists of grinding the outside, as shown in Fig. 6, to give a smooth finish. It will be noted that, in the fourth operation, the cut is taken from the inside to the outer surface, so that the burrs raised will be on the outside. This makes a burring operation unnecessary, as the final operation of grinding removes these burrs as well as those resulting from the hobbing operation.

* * *

A Competition in Drill Jig Design

The American Machinery and Tools Institute, 40 N. Wells St., Chicago, Ill., has announced a prize competition in the design of drill jigs. Designers and toolmakers are invited to participate in this competition, which covers drill jigs of several types specified to be used as model jigs in the standardization work of the American Machinery and Tools Institute. Certificates of merit for the three best designs submitted of each type will be awarded by a committee of judges composed of engineers of high standing.

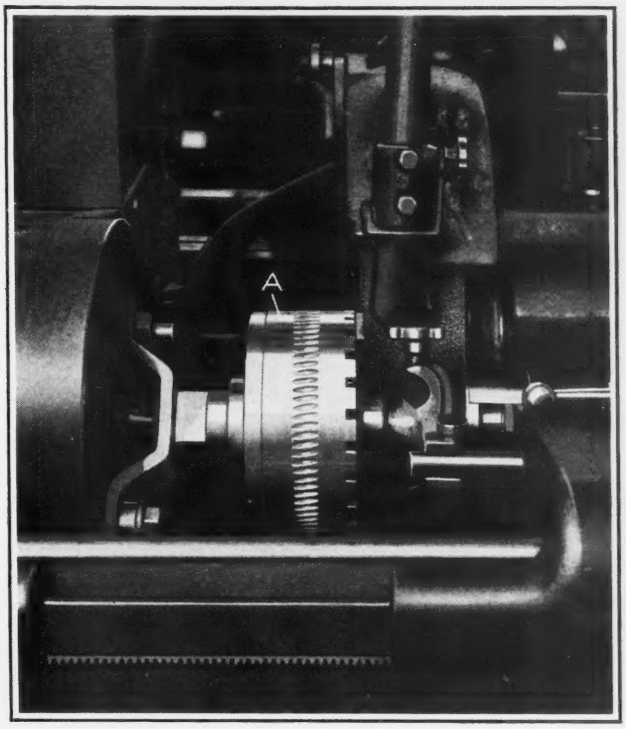


Fig. 6. The Final Operation of Grinding Removes Burrs and Gives a Smooth Surface

Those who wish to enter this competition are invited to communicate with the American Machinery and Tools Institute. The sketches or drawings to be submitted must be in the hands of the Institute by October 30, 1931. The ten best of each type will then be selected and finished drawings must be available by November 30.

* * *

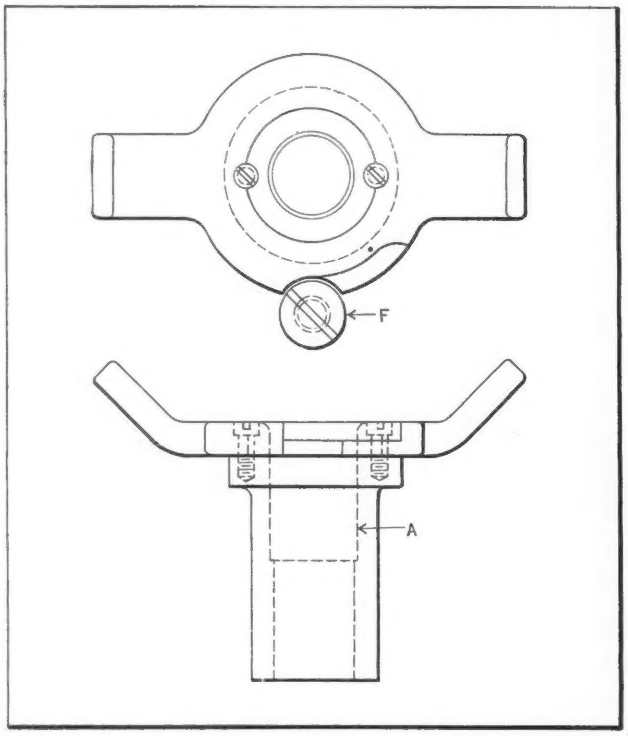
To decrease the price paid by the consumer is equivalent to increasing wages.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Handle for Large Drill Bushing

A large drill bushing equipped with a handle is shown in the accompanying illustration. The object of the handle is to enable the operator to remove the bushing easily, as the bushing is of the slip type and is likely to grip the liner bushing or bore in the jig. In this case, the bushing is made of machine steel and is pack-hardened and ground. The bore is relieved at *A* to reduce the wearing surface and also to prevent cramping of the drill.

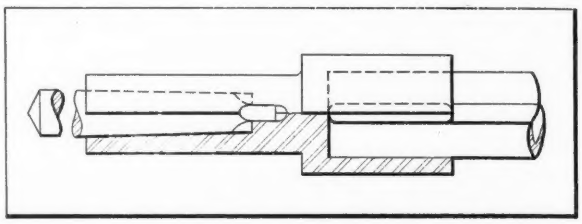


Large Drill Bushing of Slip Type Equipped with Handle to Facilitate Removing it from Jig

The handle is bent at an angle at both ends to provide room for the operator's fingers, and is attached by screws to the shoulder of the bushing. A lock-screw *F* in the jig body holds the bushing in place during an operation, and by giving the handle a partial turn to the left, the bushing can be easily removed from the jig. H. M.

Drill and Reamer Holder for Tailstock Spindle

Using the tailstock spindle as a holder for drills and reamers generally causes the tapered hole in the spindle to become scored. In most cases, the



Scoring of the Tapered Center Hole in the Tailstock Spindle is Eliminated by this Simple Drill-holder

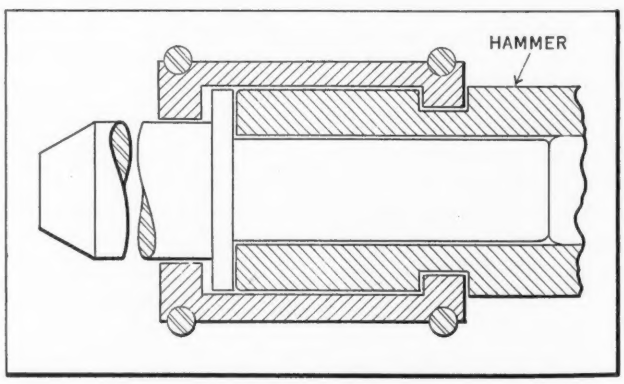
scoring is enough to throw the tailstock center off and introduce errors in subsequent turning operations. The holder shown in the illustration avoids this difficulty. One end of the holder is bored for a slip fit over the end of the spindle, while the other end has a tapered hole for the drill or reamer. A keyway is cut in the end of the spindle for the drive key, which is secured in the holder.

Rockford, Ill. W. E. Gunnerson

Safety Guard for Rivet Set Used in Air Hammer

In using an air hammer for riveting, some means is usually employed to prevent the rivet set from dropping out of the barrel or endangering other workmen by being thrown out if the trigger is accidentally depressed. Troublesome occurrences of this sort may be prevented by the use of the simple device shown in the illustration.

It consists of a split bushing having a recessed bore slightly greater than the diameter of the hammer barrel. One end of the bushing is machined to fit an annular groove turned in the barrel, while the other end is bored slightly larger than the projecting portion of the rivet set. The recessed bore should be long enough to provide about 1/8 inch endwise movement of the set.



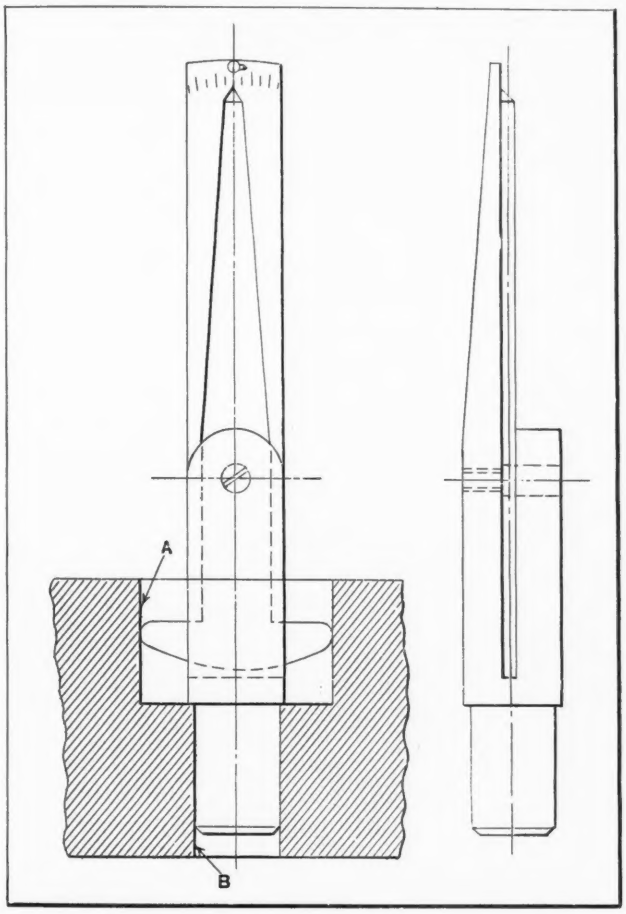
Split Bushing Used to Prevent Rivet Set from being Accidentally Forced from Air Hammer

It was necessary to split the bushing, so that it could be slipped on or off the barrel when the rivet set was to be changed; but in operation, the bushing is locked securely in position by the two spring steel rings which fit in grooves in the bushing.

Denver, Colo. R. M. THOMAS

Gage for Testing Concentricity of Counterbore

The accompanying illustration shows an indicating gage for use in checking the concentricity of a counterbore *A* with the hole *B*. In making a gage of this kind, the materials used and the accuracy with which the parts are made should correspond with the degree of accuracy required in the work. The length of the indicating needle, the amount of amplification, and the graduations can be made to suit requirements. The construction of the gage is clearly shown by the illustration, and should require no further explanation.



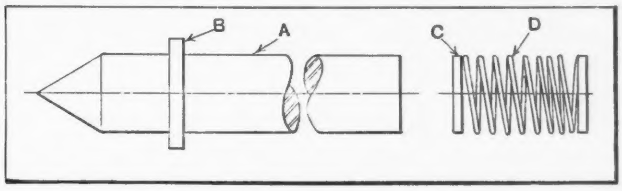
Gage for Testing Concentricity of Counterbore

Toronto, Ont., Canada CLIFFORD CORNWALL

Quick-Acting Tailstock Center

A tool that can be constructed by any machinist easily and quickly and one that will save time on many jobs is shown in the accompanying illustration. The center *A*, having a straight shank to fit the lathe tailstock, is provided with a collar *B* bored out to give a tight press fit on the center. The end pieces *C* are approximately 3/32 inch thick and have a spring *D* soldered, brazed, or welded to their surfaces as illustrated.

The spring assembly is placed in the hole in the tailstock, after which the center is inserted, the collar *B* acting as a grip for the thumb when pushing the center back. The spring will allow the center to recede just enough to permit the work to be inserted between the centers and at the same time hold the work securely when the stop-handle is tightened. All the operator has to do is to release the stop-handle, push the center back, remove the work, insert a new piece, and tighten the handle.



Quick-acting Center for Lathe Tailstock

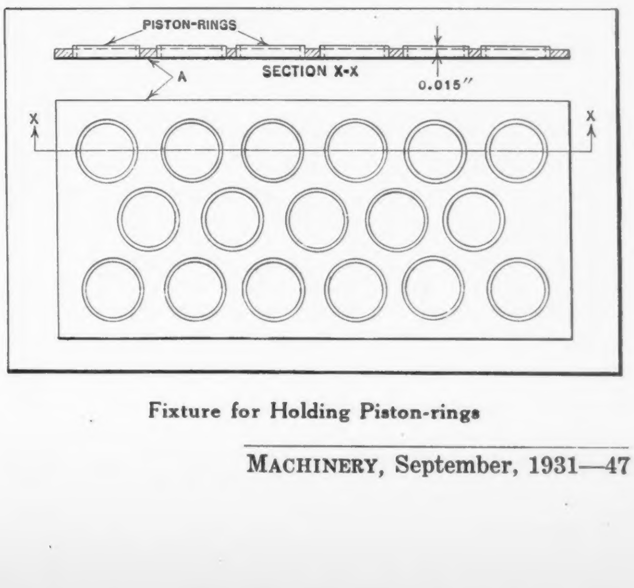
Boston, Mass. CHARLES R. WHITEHOUSE

Fixture for Holding Piston-Rings on Magnetic Chucks

The simple plate type fixture shown at *A* in the accompanying illustration was devised for holding a gang of piston-rings on a magnetic chuck while grinding the sides of the rings. This type of fixture proved very satisfactory for holding rings either before or after they were parted or slotted. The holes in which the rings are nested are made 0.010 inch larger than the diameter of a solid ring or 0.010 inch larger than the diameter of a slotted ring when compressed.

The additional holding surface provided by the fixture makes it possible to take heavy cuts. When the grinding operation is finished and the chuck has been demagnetized, the entire fixture, together with the rings, is slid off the face of the chuck. The dust from the wheel and the work can then be removed easily from both the fixture and the chuck.

Dayton, Ohio F. J. WILHELM



Fixture for Holding Piston-rings

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

W. T.—In cutting a worm thread, how is the width of the lathe tool point determined, so as to get the right width at the bottom of the thread? According to one formula, the width of the tool point equals the pitch of the worm multiplied by 0.31. Does this formula apply only to a worm thread having an included angle of 29 degrees, and does it give the width at the bottom of the thread groove as measured in the plane of the worm axis? Also give the rule or formula for determining the depth of the thread.

A.—If a worm thread has an angle on each side of 14 1/2 degrees, or an included angle of 29 degrees, then the width at the bottom of the thread groove in the plane of the axis or the width of the threading tool point equals 0.31 times the pitch of the worm. Many worm-gears used at the present time, especially for power transmission, have thread angles larger than 29 degrees, because multiple-thread worms are used to obtain higher efficiency, and larger thread angles are necessary in order to avoid excessive under-cutting of the worm-wheel teeth. According to the recommended practice of the American Gear Manufacturers' Association, worms having triple and quadruple threads should have a thread angle of 40 degrees, and some manufacturers of worm-gearing, especially when the helix or lead angle of the thread is quite large, use a thread angle of 60 degrees.

The following formula may be used for determining the width of the tool point for cutting a worm thread of any angle. In this formula,

P = pitch of worm thread or circular pitch of worm-wheel;
a = one-half included angle of thread;
S_1 = depth of worm thread from the pitch line or the dedendum;
S = height of worm thread from the pitch line or the addendum;
T = width of threading tool point; and
W = width of worm thread at top.

$$T = \left(\frac{P \times \cot a}{4} - S_1\right) \times 2 \times \tan a$$

By substituting S for S_1 in the formula, the width of the thread at the top may be determined, thus:

$$W = \left(\frac{P \times \cot a}{4} - S\right) \times 2 \times \tan a$$

The widths obtained by this formula are in the plane of the axis. If the required width is in a plane normal or square to the thread, multiply the width W or T by the cosine of the helix or lead angle. The cotangent of this helix angle equals the pitch circumference of the worm divided by the lead.

If we assume that the included angle of the worm thread is 29 degrees (a = 14 1/2 degrees) and that its total depth, in accordance with the usual practice for a worm thread of this angle, equals $P \times 0.6866$ and S equals $P \times 0.3183$, then S_1 equals $P \times 0.3683$. When these values are inserted in the formula, we have

$$T = \left(\frac{P \times 3.8667}{4} - P \times 0.3683\right) \times 0.5172$$

Therefore,

$T = (P \times 0.9667 - P \times 0.3683)\ 0.5172 = P \times 0.499 - P \times 0.19 = P \times (0.499 - 0.19) = P \times 0.309$ or $P \times 0.31$ approximately. This final expression, it will be seen, is the simplified formula for the 29-degree thread, and by following the same procedure the general formula given may be simplified for any thread angle.

If the helix or lead angle of the worm thread exceeds 15 or 20 degrees, it is common practice to reduce the depth of the thread by using the normal instead of the axial pitch of the worm in the formulas. Thus, if P_n equals normal pitch, the total depth equals $P_n \times 0.6866$ instead of $P \times 0.6866$. This normal pitch P_n equals $P \times$ cosine of the helix angle. According to the recommended practice of the American Gear Manufacturers' Association, the whole depth for single- and double-thread worms equals $P \times 0.686$, and for triple- and quadruple-thread worms equals $P \times 0.623$.

* * *

Improved Lighting Reduces Industrial Accidents

According to R. L. Zahour, lighting engineer of the Westinghouse Lamp Co., Bloomfield, N. J., it has been definitely shown that improved lighting will reduce industrial accidents. In one factory having 1000 employes, 425 accidents were reported in one year, with a compensation cost for injuries of $15,000. Misplaced illumination economy and poor lighting were the chief causes of many of these accidents.

Then a new well planned lighting system was installed. At the end of the first year, accidents had been reduced in number to 170, and the compensation cost amounted to only $6000. The lighting bill had been increased from $1900 to $3700, but the decrease in accident compensation more than outweighed the increased cost of lighting; in fact, there was a net saving of $7200 that could be credited almost entirely to good illumination.

What Russia is Doing

By C. EDGAR ALLEN
Editor and Director, MACHINERY PUBLISHING CO., LTD.

This comprehensive report just received from MACHINERY'S special representative, deals with Russian market possibilities for shop equipment manufacturers, reviews the present industrial conditions and the plans for gigantic future developments. During 1930, American manufacturers sold industrial equipment to Russia amounting to about $40,000,000. Nearly $30,000,000 was for machine tools and shop equipment. Can the five-year plan, even if 100 per cent successful, supply the demands of 160,000,000 people?

THE Russian revolution has brought into existence a set of conditions unique in interest and importance to the whole world, conditions affecting a country of 160,000,000 inhabitants. Soviet Russia has socialized its land and means of production, and, without experience in organized mass production, is making the attempt to adjust its resources to supply the needs of its people.

It is the process of industrialization that holds a practical interest for machine builders and manufacturers of mechanical equipment in other countries, an interest that is measured by Soviet requirements in the shape of machinery and mechanical equipment which manufacturers in the United States and other countries are in a position to supply.

These requirements are not wholly dependent upon the five-year plan of industrialization, but ultimately upon those of the vast population which brought the plan into existence. It is necessary to bear this in mind when considering the duration of the market, for it is quite impossible that all the Soviet factories finished and equipped by October, 1933, will be adequate to fill the requirements at that date; nor for years to come.

The improved scale of living which the results of the five-year plan are intended to provide will, in turn, call for further plants and manufacturing equipment, and so on. Soviet planning may aim ultimately to catch up with and satisfy these requirements by means of its own factories, but such an achievement will certainly be in an indefinite future.

This applies particularly to machine tools which are not of the common or usual types. Outside of engine and turret lathes, plain milling machines, upright and radial drills, no planning of any magnitude appears to have been done. It may be asked, what about such production equipment as precision grinding machines, chucking automatics and screw machines, and presses? All these will be required in thousands to secure the free and unhampered development of Soviet light industries. Neither do heavy machines appear to have figured in the program and importations doubtless will continue.

Moreover, there is the tremendous difficulty of securing an adequate supply of skilled workers, and this applies more intensively in the machine tool field. Accelerated training and speeding-up methods may be a feasibility when it is a question of machining a motor-car cylinder block, but it will tax all the resources of the factory training shops, even if they do work day and night, to turn out the skilled men which are necessary in machine tool building. All this points to a retardation of productivity in respect to Soviet machine tools.

It is clear, therefore, that for some years ahead there will exist an important market for machine tools, and in a wider sense the development of the machine-building industry, in view of the enormous requirements, should not interfere with large-scale importation of foreign equipment.

The purchasing organization for machine and small tools and other mechanical equipment was originally that known as Metallo-Import, but with increasing developments, it became necessary to sub-divide its functions. The divisions now consist of:

1. Orga-Metall (address: Kalanchewskaya Ulitza, 5a, Moscow), which is the demonstration department and show-room for all foreign machine tools and production equipment.
2. Stanko-Import (address: Kusnetzki Most 23, Moscow), through which negotiations for the supply of all machine tools, small tools, jigs, fixtures, precision apparatus, furnaces, heat-treatment equipment, etc., are effected.
3. Metallo-Import (address: Kalanchewskaya, Ulitza, 5a, Moscow), which is concerned with the purchase of heavy machinery, metallurgical equip-

Is Russia Through Buying—or Just Beginning?

ment, presses, power hammers, punching and shearing machines, together with such equipment as boilers, engines, cranes. These departments act in close cooperation and not in a spirit of independence.

4. Elektro-Import (address: Kusnetzki Most 12, Moscow), electrical machines and equipment.

In addition to the trading organizations mentioned, there are a number of other bodies which decide upon the equipment required to supply the needs of the factories under their control.

Where Machine Tools are Demonstrated under Working Conditions

The Orga-Metall department, which is under the control of a director, M. Gorelov, and a chief engineer, occupies three or four floors of a spacious new block of buildings situated in the Kalanchewskaya Ulitza, Moscow. The main area is devoted to a demonstration hall in which are installed, under working conditions, examples of all machines and other equipment sent by American, English, German, French, and other manufacturers. Here the machines may be inspected by works directors, managers, and engineers from all over the Soviet Union, and the ultimate selection of equipment will much depend upon the inspection and demonstration here made and given. It cannot be too strongly impressed upon manufacturers of machine tools and works equipment, who would do business with the U.S.S.R., that this department is of basic importance.

The Orga-Metall organization, important as it is, does not eliminate the necessity of making a direct approach to the executives and engineers of the individual plants, and it is advisable, and even necessary, that direct contact be made by members of sales organizations of firms supplying machines and production equipment.

Firms must be lavish with the literature of their products in the Soviet Union and see to it that works directors, works libraries and libraries of the controlling organizations and Orga-Metall are well supplied. If the literature be printed in the Russian language, so much the better. Some of the higher executives read, if they do not speak, English, but more appear to know and use German.

Examples of Work and Spare Machine Parts Required

The aim of Orga-Metall is to have all machines installed under running conditions, ready for instant demonstration to works visitors. It is highly important, therefore, to send out samples of work or parts produced by the machine, together with necessary work-holding and tool equipment. Some of the German manufacturers provide neat and attractive glass show cases to contain the work specimens. Also, it is important to send a set of spare replacement parts in case of breakage.

The charge made for installing a machine in the Orga-Metall demonstration department is $7.50 per square meter (10 3/4 square feet) of floor space occupied per six months. No charge is made for show cases, show cards, or pictures of works. Every machine must be tooled up free of cost, and it is desirable, in the first instance, to send over a demonstrator.

Central Organization for Dealing with Machine Tool Imports

The Stanko-Import Corporation is the central organization dealing with the import of machine tools of the manufacturing, heavy or general purpose and repair types; small tools; chucks, jigs, fixtures; furnaces; shop equipment, with the exception of presses, punching, and shearing machines, power hammers and heavy equipment. Most of the technical correspondence relating to purchase problems is conducted by this organization. It appears probable that more business will be done direct by Stanko-Import than formerly.

Those firms that are desirous of making sales to Russia are advised to make contact with the chairman of Stanko-Import, M. Sorokin.

Exports from the United States to Russia During 1930

According to Russian statistics, exports during 1930 from the United States, consisting largely of machine tools, amounted to $30,000,000.

According to a report made by the United States Department of Commerce, shipments of industrial machinery to Soviet Russia in 1930 amounted to just under $40,000,000, but those figures include Diesel engines, water turbines, excavators, cranes and conveyors, mining, oil well and pumping machinery, machine tools and foundry equipment, ball bearings, air compressors, paper and pulp machinery.

Exports of machinery from Germany to Russia, according to Russian figures, amounted during 1930 to $38,720,000. In this case, also, it is stated that machine tools accounted for the greater part of these figures.

Importance of Credits

The question of credits assumes for many manufacturers a greater importance than that of price. It is authoritatively stated that the average duration of all credits at present does not exceed 10 to 11 months. A wide diversity of credit terms negotiated, however, goes to make up this average, and it may be noted that in the United States the tendency recently has been to tighten credit facilities which is resulting in a decline in the purchases made by the Soviet Union.

During the period October 1, 1930, to March 31, 1931, Soviet purchases decreased by 44.8 per cent as compared with the corresponding period in the previous year. This may be partly due to the economic crisis, but it is ascribed by the Director of the Amtorg—the commercial agency of the Soviet Government in New York—to the lack of improvement in financing Soviet orders. "This situation," he observes, "contrasts strikingly with the improvement

noted in credit and other commercial facilities extended to Soviet trade organizations in European countries, notably in England and in Germany, where a new agreement covering large credits to the Soviet Union has been concluded; in Italy (also in France) where a trade agreement is being negotiated; in Austria, Norway, etc." During the first quarter of 1931 Soviet purchases in Germany increased by 35 per cent.

The most general terms for standard machinery stipulated by American machine tool builders have been 50 per cent of the purchase price when the machinery was delivered at port of shipment; 25 per cent in three months, and 25 per cent in six months.

A few manufacturers have refused to sell on anything but a cash basis, and where equipment has had to be built to special designs, cash with order has been asked for. Other terms have been one-third when delivered at shipping port, one-third in 45 days and one-third in 90 days. In the case of small tools, longer terms have been granted.

Longer terms, we understand, have been arranged outside the machine tool industry. At least two manufacturers in the United States have granted credits extending over two years, and tractors have been bought on credits extending over several years. According to Orga-Metall, the credits arranged with German machine tool builders have ranged from 21 to 24 months.

Russian Industries Require Technical Assistance

It is the object of the five-year plan and of subsequent planning to equip the Soviet factories to the highest point of efficiency. Such equipment requires a special personnel and special knowledge. And this is the weak spot in the Soviet position. Their lack of experts and skilled workers renders it necessary for the Union to "import" technical advice as well as equipment. It is stated that, during 1931, the Soviet Government will be compelled to "import" more than 13,000 foreign engineers, technicians, and skilled workers to insure the construction program being carried out. These are to include Englishmen, Germans, and Americans.

View in the Tool-room of the Rostov Agriculture Machinery Factory

The Machine Tool and Small Tool Industry in Russia

Although at first machine tool building appeared to figure as an afterthought in the scheme of Soviet industrial planning, there is now a lively realization of the necessity for increasing the "tempo" of enlarging and re-equipping the old and erecting the planned new machine tool factories. Only engine

lathes and machines of simple type are at present being produced, and even under the new development scheme the building of elaborate and expensive machines is not apparently to be undertaken.

The two gigantic factories which Soyusstanko-instrument—the tool planning organization in Moscow—have under construction, viz., "Frezer" and "Kalibr," are designed to help fill the requirements of Soviet industry in respect to milling and other cutters, jigs, fixtures, and "control" apparatus. They will employ 12,500 people.

Piecework System Now Applied Generally

There is a continuous exhortation to reduce costs which suggests that the conditions under which plants are operating present difficulties. Cost reduction is no mere accessory to the five-year plan, but is basically important, since on lowered costs depend the savings which form the capital investment of the immediate future. Only at works of key importance was the piecework system introduced at the beginning of the plan, but not less than 75 per cent of the factories are now placed on piecework, and this system of payment is to be extended almost everywhere throughout the Soviet Union. Prizes for cost cutting are to be awarded to those who fulfil the plan for maintaining quality of work combined with lowered production costs.

A variation in the key-methods has just been announced which will introduce the principle of a higher rate of payment to skilled workers. This has been found necessary in order to get them to remain on their jobs instead of moving to another factory or center every three months to obtain better conditions, as very frequently happens.

Wage Scales in Russia

Soviet statistics give the average wages in large scale industry per month in roubles as 1926-27, 61.63; 1928-29, 74.25, for the whole of industry. In metal working, the figures are, for 1926-27, 73.01; 1928-29, 87.20; mechanical engineering 76.84, 97.20. At the large plants, as at Stalingrad, wages run from 2 to 5 roubles per day, and skilled toolmakers may earn up to 10 roubles a day.

[The par rate of the rouble, or the price paid for it at the frontier or at the U.S.S.R. bank in cashing a credit note, is about 51 cents.]

The salaries of the executives are graded, and specialists may receive a high rate of pay. The true communist, and communism is the growing section of the Union, is supposed not to accept, however, more than 300 roubles per month ($153).

The Work of "Shock Brigades"

Output incentive is supplied by groups of what are termed "shock brigades" and "shock workers." These consist mainly of young and enthusiastic people—communists—who, earnest of purpose in bringing to success the five-year plan, set the "tempo," fire the less efficient with the spirit of emulation and encourage them to a more intense effort.

Department competes with department and factory with factory, the relative output and progress being depicted almost daily on wall charts or wall newspapers, often graphically and in an amusing manner.

Workers reach the "shock" status on the double basis of quantity and quality output. They occupy a "top of the class" position in the factory, and gradual improvement means a shifting of seat or bench until the shock position is reached. In the Lepsa electrical works, for example, the girls in the stator winding department are on piecework and earn from 120 roubles up to "shock" rates of 170 roubles per month. The quality of work is indicated by the percentage of rejects, which over-all in the department is 1 per cent, and in the case of the shock brigade itself, one-quarter of 1 per cent. The "Young Communist" shock brigade at these works has just been awarded the highest honor conferred by the Soviet Republic for finishing the five-year plan in 2 1/2 years.

Pig Iron and Machine Construction

Pig iron is a fundamental factor making for the success of the five-year plan; the development of metallurgy is held to determine the possibilities of all other branches of industry, and defines the limit of their expansion. The original program was the production of 10 million tons of pig iron for 1932-33, but this has now been raised to 17 million tons, 59 per cent of which will be produced in the reconstructed old plants and 41 per cent is to be provided by a group of giant new blast furnaces, such as those at Magnitogorsk, in the Urals, Kugnetsk in Siberia, Kerch in the Crimea, and Zaporozhe in the Ukraine. The final annual capacity of the first-named plant is to be 4 million tons, which will place it among the largest in the world.

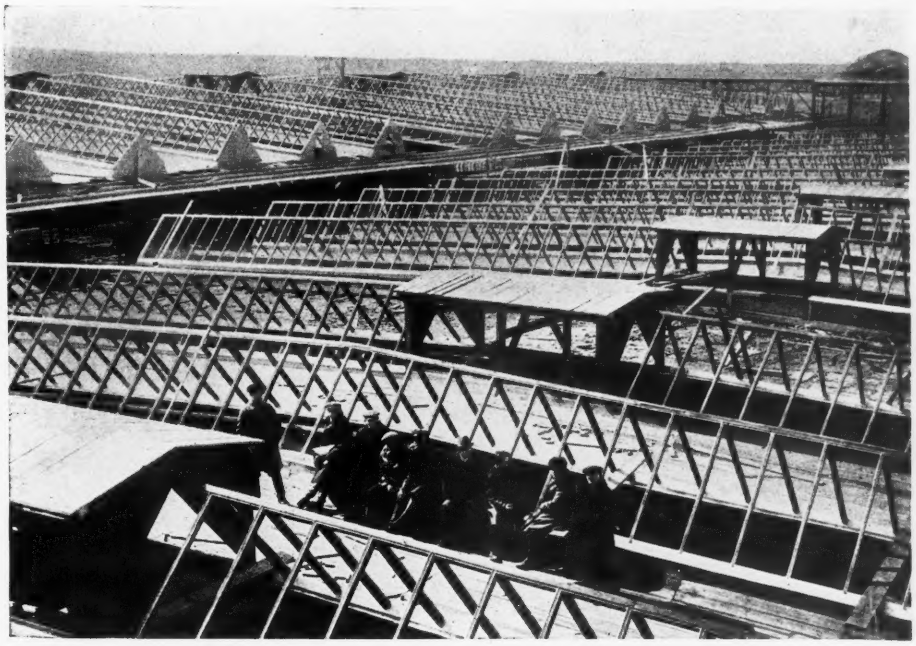
The range of manufacture comprehends steam boilers and turbines, Diesel engines, mining machinery, locomotives, automobiles, tractors, construction machinery, textile machinery, and agricultural implements. The general policy is to limit the types of machinery to as few as possible and to meet the problem of production gradually, in order to secure experience before proceeding.

Plans for Automobile Production

The Autostroy factory in Nizhni-Novgorod is destined to convert this old-world town on the Volga into the Soviet Detroit. Two hundred and fifty million roubles is stated as the cost of construction, and the ultimate output 200,000 automobiles a year. The revised scheduled time for the completion of this work is November 1. Twenty-five thousand men and women are concentrating on the job at a terrific tempo.

At first the plant will serve only for assembly on the American plan of parts sent from Detroit to Nizhni, the supply of more than 70,000 sets of components, as well as blueprints and technical assistance, forming the essential features of a contract entered into with Ford.

The plant will then enter gradually into the pro-



View Showing the Magnitude of an Unfinished Plant in Moscow, in which Cutters, Jigs, Fixtures, and "Control Apparatus" are to be Manufactured

duction of parts, increasing steadily until, at the end of the fourth year, complete cars of its own manufacture will be turned out.

The Amo plant in Moscow is an old automobile plant which has been reconstructed and reorganized. Built at a cost of 5,200,000 roubles ($2,650,000), it is expected to assemble 30,000 commercial chassis per annum.

Ball and Roller Bearings

The demand for ball and roller bearings is vast and insistent. At present there is only one factory, operating under a Swedish Concession, in the U.S.S.R., for the production of these accessories, the yearly output of which is a million bearings.

The Sharikopod Shipnikstroy Works, Moscow, now in the course of erection are planned to produce 8 million bearings in the first year, with an ultimate capacity of no less than 24 million bearings per annum. This figure is estimated to cover 17 per cent of the demand that will be experienced in 1935, when the motor, tractor, transport, and aviation industries are in full swing.

Plans for Largest Tractor Plant in the World

A factor of importance in the program of machine construction in the five-year period is the development of tractor production. This involves the construction of what will be the largest plant of its kind in the world at Stalingrad (formerly Tzaritzin) at a cost of more than 77,000,000 roubles ($39,270,000), and with an annual capacity of 50,000 tractors; a plant of similar capacity at Kharkov; another at Chelyabinsk in the Ural territory, with a capacity of 30,000, and the enlargement and re-equipment of the tractor department of the Putilov Works at Leningrad to produce 50,000—a total production of 180,000 per annum. Putilov produced its 25,000th Fordson tractor early in June, and the Dzierzynski plant at Stalingrad, which started operations a few months ago, reached, in May, 94 per cent of its scheduled output of 1620, with 1523 tractors.

The total output of tractors from all plants in April was 2704, a figure which represents an increase of 136.4 per cent over the previous month. It is but a faint start, but a rate of increase in production is indicated which, if maintained, will mean very rapid progress toward full capacity.

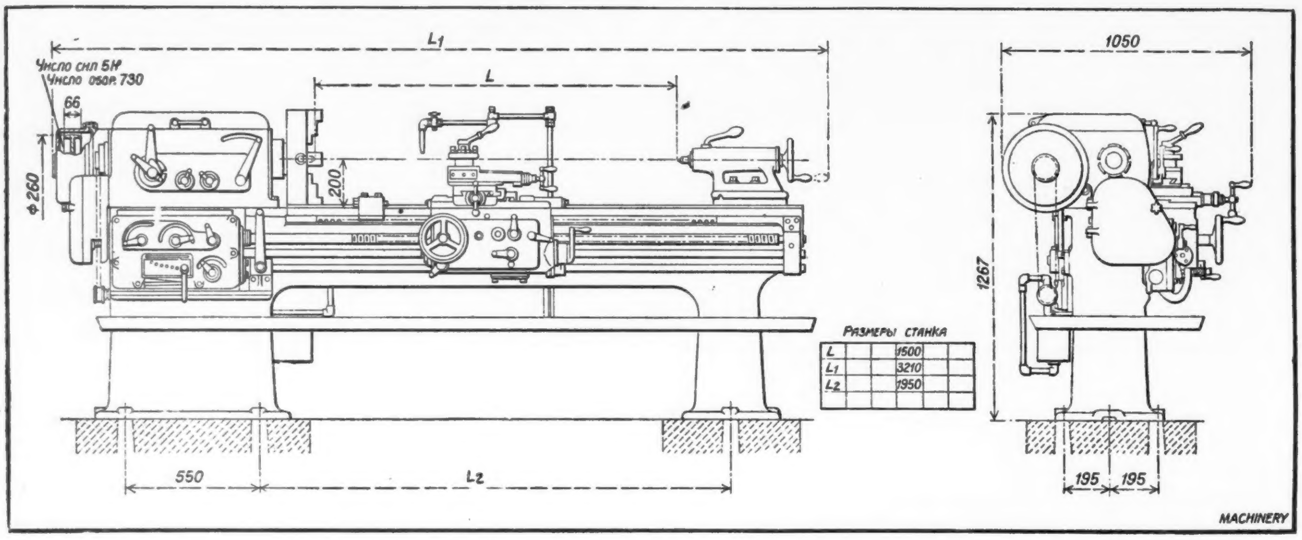
Stalingrad was completed ahead of time, and practically all the equipment, which is mainly American, is now installed. The assembly department is more than 1320 feet long by 415 feet wide, and is laid out on the American plan. The assembly belt is timed for a normal speed of 2 feet per minute, from which one tractor will leave every five minutes. The tractor manufactured is a 2-ton, 15-30-h.p., wheeled "International" type machine,

and is assembled from Soviet-made components with the exception of the carburetor and magneto. At present 7000 workers, mostly young people, are on production, and many of them are women. Group superintendence is provided by American workmen, who act as overseers until efficiency is reached by the Soviet operators.

Plans to Manufacture Standardized Lathe

Krasny Proletarij, Moscow, is one of the three old machine tool plants of the U.S.S.R. which have been planned for reconstruction. Besides machine tool building, part of the plant is engaged in the manufacture of small Diesel engines which will, however, be moved.

In the machine tools works, 1200 men are employed producing 200 lathes per month. These machines are of the cone pulley type in two sizes, 150 and 200 mm. height of centers (5.9 to 7.87 inches). Next year the works will turn over to the production of the new Soviet standard lathes which follows very closely the design of the German standard machine. It is planned for three sizes, of 150, 200 and 300 mm. height of centers (5.9 to 11.8 inches). Director Legenchenko informed me that the expected output in 1933 is 6000 lathes.



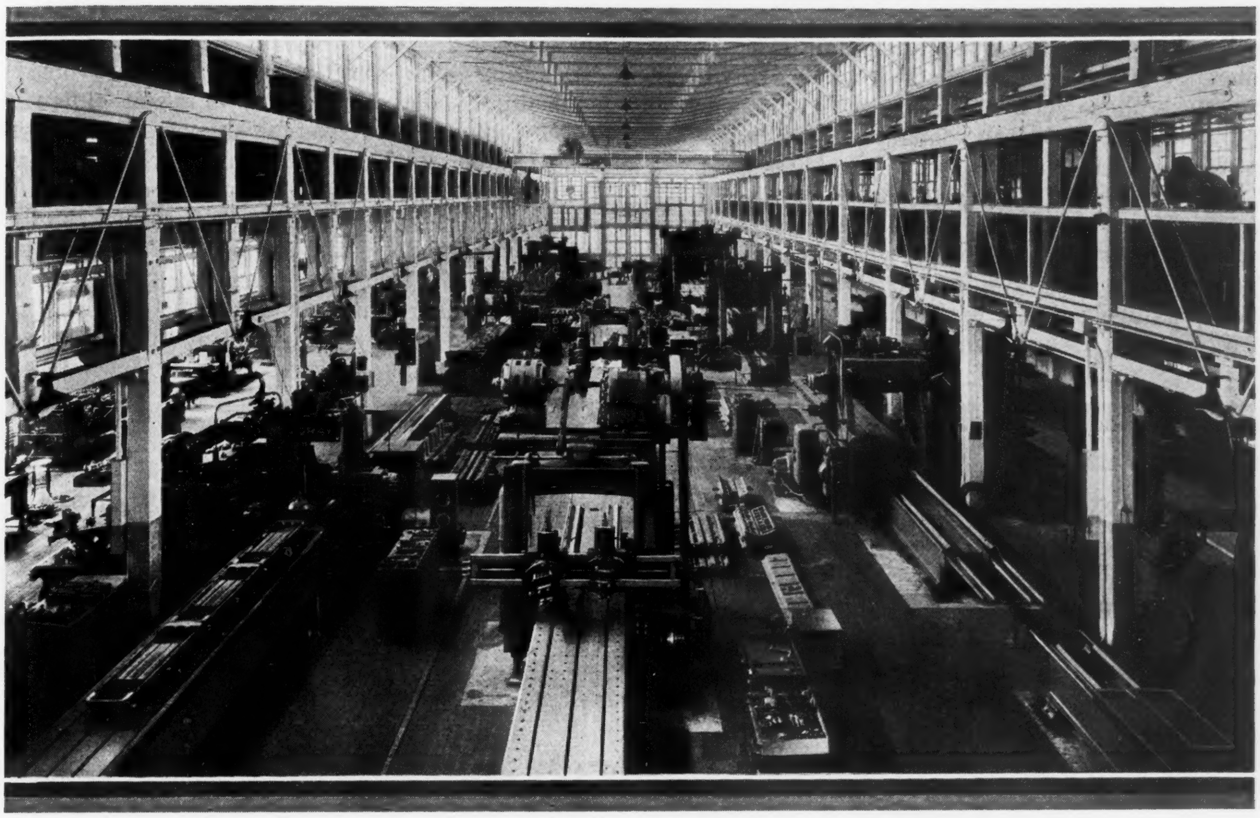
The New Soviet Standard Lathe. The Expected Output in 1933 is 6000 Lathes

Seven thousand men in Dinamo Zavod, Moscow, are producing electric tram motors, controllers and electric trucks giving an output last year priced in roubles at 38,000,000. This year it will be raised to 44,000,000, and next year to 85,000,000.

At Lepsa Electro Zavod, Moscow, there are 2000 workers who furnish an example of good organization. Reference was made to their shock brigade and their first-class piecework output. Among other activities these works will ultimately provide all the flange motors required by the machine tool industry. Sixteen thousand fractional horsepower motors will be produced this year, stepping up in 1932 to 100,000 and to 240,000 in 1933. The scheduled production for larger sizes—from 1 to 20 horsepower—is 1931, 30,000; 1932, 50,000; and 1933, 60,000.

Over 500 Factories Scheduled for Completion This Year

The above examples are but a few indicative of many developments that are planned in the field of Soviet machine construction. Space will not permit more than the mention of the Metal Works in Leningrad, the Parostsoy in Moscow, and the Taganzog plant, which will build boilers and produce between them 300,000 sq. metres of heating surface; turbine construction at the Leningrad Metal Works, with an output of 650,000 kilowatts; the mining machinery program, involving the rebuilding of the Kramator machine plant at a cost of 45 million roubles, and the plant at Sverdlovsk, at a cost of 49 million roubles; locomotive building handled at first by the Lugansk plant, which is rated to produce 350 high powered engines per annum by the end of the 5-year period, and accounting for an outlay of 40 million roubles; the car and wagon building plants calling for an expenditure of 160 million roubles; staggering figures for agricultural machinery plants; 180 million roubles for the plants at Rostov and Omsk and the reconstruction of a number of plants in Soviet Russia and the Ukraine. And so on, through almost every other phase of industry, the imagination is gripped by this colossal plan. Its completion depends upon many factors, not the least upon the spirit of the population, particularly the younger section. Many of the new factories are in production. More than 500 are scheduled for completion this year. The present deprivation is the measure of the enthusiasm of the young communist proletariat for the completion of the plan.



A Machine Tool Plant Takes its Own Medicine

By a Careful Study of Manufacturing Methods the Norton Co. Has Increased Plant Capacity 25 Per Cent

DURING the current business depression many companies engaged in the building of machine tools have emphasized the advantages of getting ready for future prosperity by replacing obsolete equipment and methods now. Of course, the question arises, How many of these concerns are practicing what they preach? The story to be told will indicate that the Norton Co., Worcester, Mass., has not hesitated to take "a dose of its own medicine."

The rapid expansion of the machine division of this company led to the construction of new buildings from time to time to meet pressing needs. When these buildings were erected, they were fitted with modern equipment, and these facilities were kept up to date; but as the plant increased in size, it was found that, owing to the fact that the various departments were not located in logical sequence, there was considerable back-tracking of work.

During the latter part of 1928, therefore, a plan of reorganization affecting practically all manufacturing methods and leading to improved engineering practices, was decided upon. This reorganization has now been completed with very satisfactory results. Through the relocation of equipment, replacement of older machines, establishment of a new incentive system, issuing of more complete blueprints to the shop, and functioning of a simple control system, the capacity of the plant has been increased 25 per cent without adding a single square foot of floor space. Trucking of individual pieces has been reduced 27 to 63 per cent. Other large savings have been effected.

Altogether, about 200 machines were shifted; out of a total of 350, not including such equipment as snagging grinders, blowers, oil extractors, and furnaces. About 100 new machines were installed; in one case, four modern machines replaced eleven of older type. The average age of the machine tools is now less than nine years.

Tool-cribs have been established in each department to insure quick delivery of fixtures and tools. Before the reorganization of the shop, an operator sometimes lost considerable time in setting up a new job because the tool-crib man did not supply the required tools quickly or because the foreman had not assigned a new job to him.

Today, the planning department sees that jobs are assigned ahead to each machine; a "utility" man gets the work and tools to each machine before they are needed. There is now little occasion for a machine operator to go to the tool-crib. The tool-

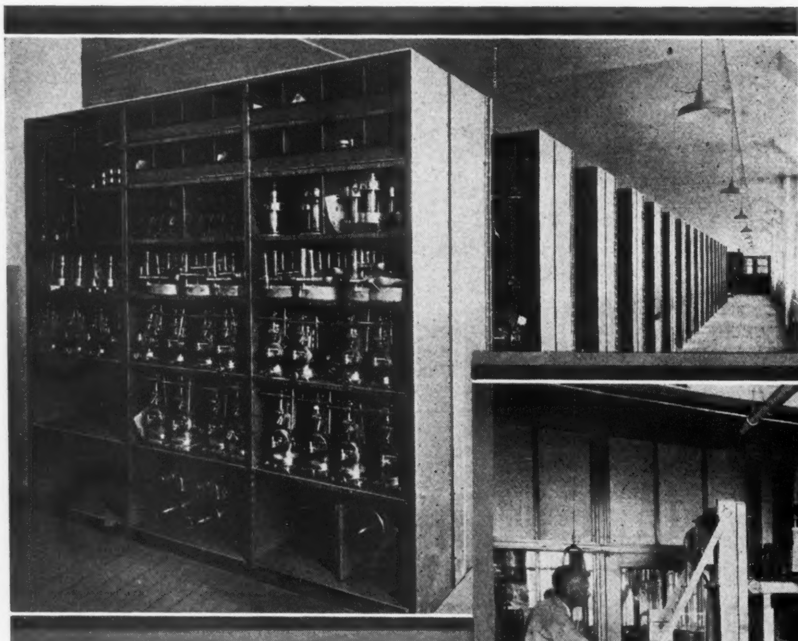
crib attendant, the utility man, and even the foreman, work under a group bonus plan based on the efficiency of the department as a whole. Obviously, the more these men cooperate with the machine operators, the higher the department efficiency and the larger their bonuses.

General overhead lighting is used throughout the plant. There are no individual lights in use except for such operations as boring, where it is necessary to look into a hole. Ceilings are white, while walls and posts are painted with aluminum to a height of 5 or 6 feet. Aluminum paint not only brightens a department, but surfaces painted with aluminum can also be kept clean easily. An unusually clean heat-treating department has been obtained by applying aluminum paint to the furnaces and other equipment.

Before this reorganization, most employes were paid on a piece-rate basis. When a new incentive system was discussed, the management insisted that any system adopted must attain two objectives: First, it must insure more money to the men; and second, it must reduce costs to the company. These objectives have been reached largely through the saving of time previously lost in getting work on machines. The system is devised on a fifty-fifty basis; that is, the machine operator receives credit for one-half of the time saved above that allowed for a job.

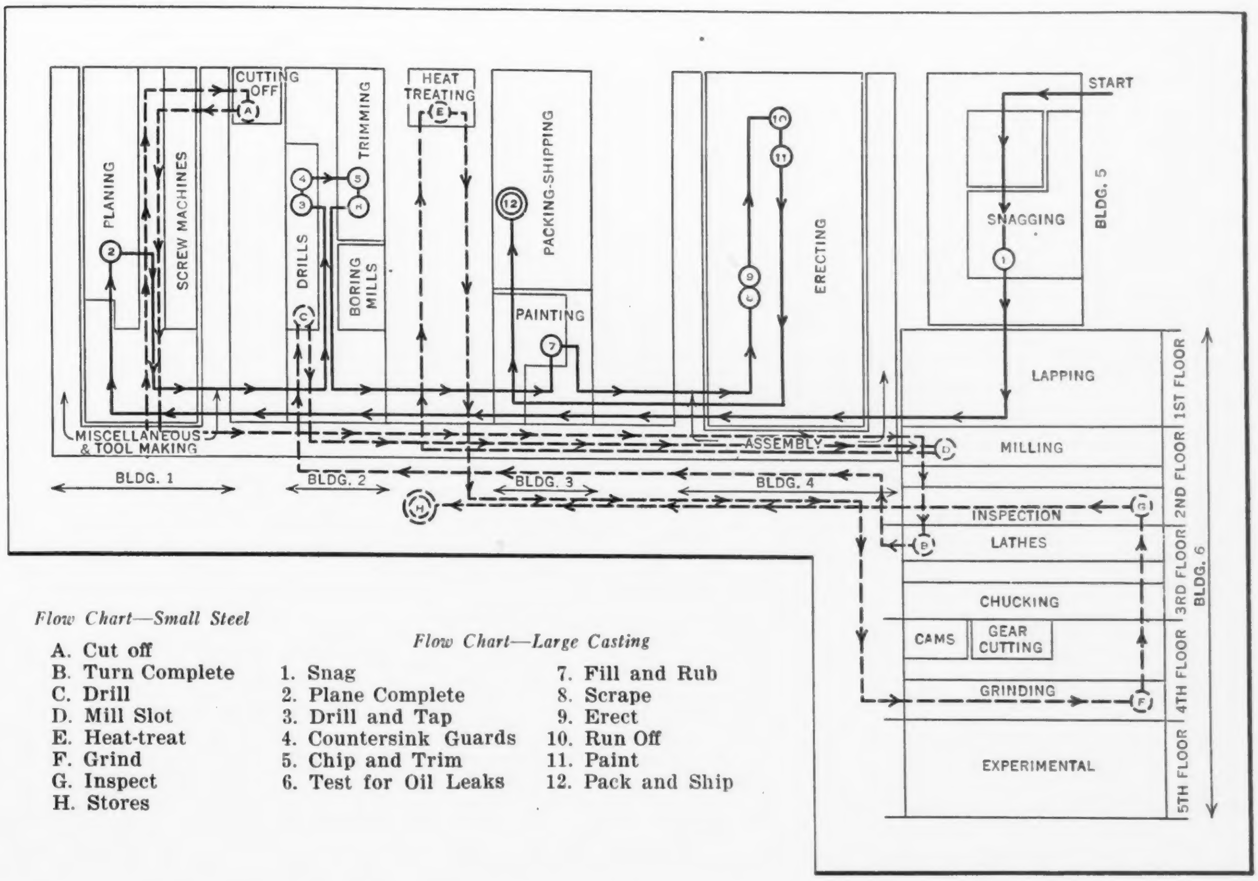
Drafting-room practice was studied from the viewpoint of the shop, and as a result blueprints are now issued that give the shop men the dimensions wanted without their having to make any additions or subtractions. Standards of finish have been established for grinding, turning, planing, and shaping, and there are samples in the drawing-room and in the shop that guarantee that there will be no misunderstandings. Instead of drawings being marked merely "Harden" or "Pack-harden," a definite heat-treatment is specified, as "Heat-treatment A-2." The foreman of the heat-treating department has complete information concerning the different heat-treatments, and thus knows exactly what is wanted.

After standards of performance were set up for each department and operation, a simple system of control was devised to insure that the standards would be reached and exceeded. Daily efficiency reports are made out for each employe by the various department foremen. Weekly efficiency charts, made out by the timekeeper, give a complete record of each man and department. From a comparison of the curves of the individual men and of the departments, it can be seen at a glance whether the



(Above) Steel Racks Having Bins that are Adjustable for Size Provide for the Systematic Storage of Finished Parts

(Below) There is a Separate Tool-crib for Each Department to Insure Quick Supplying of Tools and Fixtures to Machines for the Various Jobs



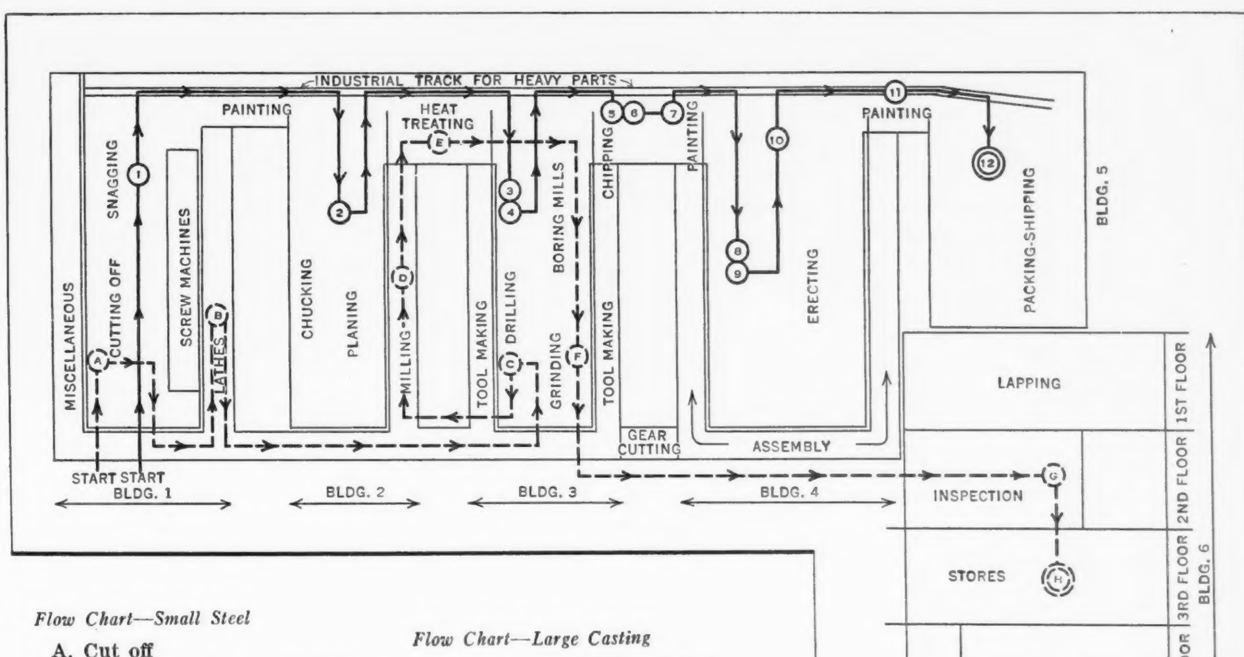
Flow Chart—Small Steel

A. Cut off
B. Turn Complete
C. Drill
D. Mill Slot
E. Heat-treat
F. Grind
G. Inspect
H. Stores

Flow Chart—Large Casting

1. Snag
2. Plane Complete
3. Drill and Tap
4. Countersink Guards
5. Chip and Trim
6. Test for Oil Leaks
7. Fill and Rub
8. Scrape
9. Erect
10. Run Off
11. Paint
12. Pack and Ship

Travel of Typical Parts through Shop Under Old Plant Lay-out (Above) and Under New Plant Lay-out (Below). Dotted Lines Represent a Small Steel Part, and Solid Lines, a Heavy Casting



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departments or men are improving in their work or tending to slacken up. Through this control system, it has been easy to keep the shop at a high degree of performance even under present business conditions.

* * *

The National Metal Congress and Exposition in Boston

The annual convention of the American Society for Steel Treating, and the annual National Metal Congress and Exposition held under the auspices of the Society, will take place this year in Boston, Mass., during the week beginning September 21. Fifty-five technical papers appear on the Society's program.

The Campbell memorial lecture has always been a feature of the annual convention. This year the lecture will be presented by Dr. C. H. Herty, Jr., supervising chemist of the metallurgical department of the U. S. Bureau of Mines' Experiment Station, Pittsburgh, Pa. Dr. Herty is widely known in the metallurgical world for his studies of steel melting.

Subjects pertaining to similar processes will be grouped together in special sessions. One of the sessions will be devoted to the problem of sheet-steel manufacture and fabrication. The papers read at this session will be of particular interest to production men in sheet-steel fabrication plants.

In conjunction with the meeting of the American Society for Steel Treating, meetings will also be held by the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the American Welding Society.

At the Machine Shop Practice Session, sponsored by the American Society of Mechanical Engineers, to be held Tuesday afternoon, September 22, at 2 P. M. at the Hotel Statler, the following papers will be read: "Power Transmission by Means of Cast-iron and Paper Pulleys," by Professor C. A. Norman and Professor G. N. Moffatt of Ohio State University, Columbus, Ohio; "Positive Drive Equipment," by C. R. Weiss, chief engineer of the Link-Belt Co., Indianapolis, Ind.; "Radiographic Inspection of Steel Castings and Welded Structures," by Herbert R. Isenburger of the St. John X-Ray Service Corporation, New York City. In addition, a motion picture film will be shown of gear research at the laboratories of the Westinghouse Electric & Mfg. Co. A motion picture of the machine tool exhibition at the Leipzig Trade Fair will also be shown.

The Society of Automotive Engineers will hold a session dealing with the problems of the automobile industry from the standpoint of metallurgy, production, and cost. This session will be held Wednesday morning, September 23, at the Hotel Statler.

The National Metal Exposition will be held on the Commonwealth Pier, while the headquarters of the various societies that will hold meetings in Boston at the time of the exposition will be the Hotel Statler. The American Welding Society will hold its meetings at the Hotel Copley Plaza.

More than 200 firms have reserved space in the exposition which, this year, will cover 60,000 square feet, an area almost twice as large as that occupied by the 1930 show in Chicago. The exposition will include products from every branch of the metal industry, together with tools and shop equipment. Welding equipment will be especially featured.

* * *

A New Book for the Handbook User

THE USE OF HANDBOOK TABLES AND FORMULAS. 210 pages, 63 illustrations, 500 problems, practice exercises, and test questions. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $1.

The practical value of any engineering handbook can be greatly increased by knowing what it contains and by applying the tables, formulas, and general data whenever they will either save time or insure accuracy. Many handbook users know only about the commonly used tables and are not familiar with the application of various special tables and sections that are extremely important in engineering and shop work.

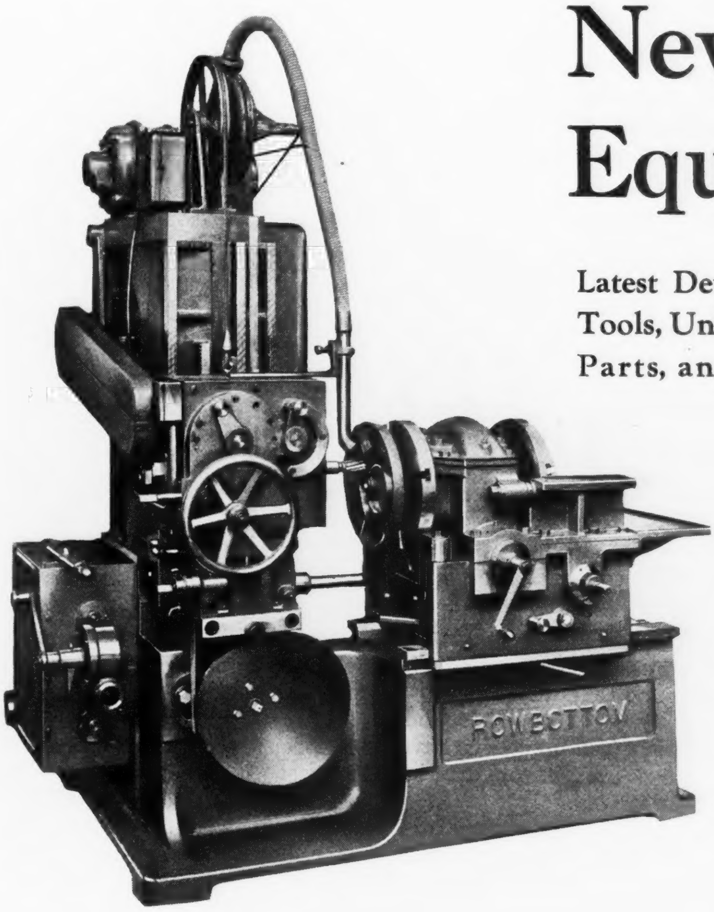
This new book serves three distinct purposes: First, it throws the spotlight on a lot of essential time-saving tables, rules, and general information in MACHINERY'S HANDBOOK that the ordinary user never discovers. Second, it shows by examples, solutions, and test questions, typical applications of handbook matter in both drafting-rooms and machine shops. Third, it provides test questions that will enable the handbook user, through practice, to obtain the required information quickly.

Even experienced engineers and shop executives will find many helpful hints in this handy book. For younger and less experienced men it provides a condensed course in mechanics, machine shop practice, and engineering, as well as a guide to practical everyday handbook usage.

In each section there are a number of carefully selected examples following the explanatory matter. The solution of each example is worked out in detail, and the handbook tables are used in connection with these solutions whenever this can be done to advantage. In this way, the practical use of the handbook is shown very clearly.

Following the examples in each section, there are "Practice Exercises" which provide material for a self-examination. Then there is one entire section of 120 "Test Questions"—an unusually interesting and instructive series of questions on mechanics and engineering, especially relating to a wide variety of handbook applications. The answers to all practice exercises and test questions are included in a special answers section.

New Shop Equipment



Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts, and Material Handling Appliances

Rowbottom Universal Cam Milling Machine

Greater adaptability and convenience of operation are features of a Model 300 universal cam milling machine recently developed by the Rowbottom Machine Co., Waterbury, Conn. This machine uses the former-follower system of the previous machines built by this company. The formers are made from cast-iron plates 1/2 inch thick, and range in diameter from 8 to 28 inches, depending upon the steepness of the rises and falls in the cam lay-out. Box cams up to 32 inches outside diameter can be conveniently handled, as well as face cams up to 28 inches in diameter and barrel cams up to 24 inches in diameter, with a travel or throw up to 12 inches. Larger cams can be accommodated by means of special handling and fixtures.

The heading illustration shows the machine arranged for cutting box or face cams, while Fig. 1 shows it set up for drum or side cams. The machine is driven by a three-horsepower motor which is belted to a swinging gear-box in which the drive to the cutter-spindle and work-head are separated. Eight cutter-spindle speeds from 50 to 384 revolutions per minute are obtainable by means of a gear-box in the cutter-slide. The cutter-spindle runs in Timken bearings. Its direction of rotation may be easily reversed by means of a sliding gear to permit the use of right- or left-hand cutters.

The work-head can be conveniently indexed on trunnions to bring the axis of the work-spindle into a horizontal position, as shown in the heading illustration, or vertical as shown in Fig. 1. Power is transmitted to the work-spindle through a gear-box which gives nine feed changes ranging from 2 to 32 minutes per revolution of the work. A shear pin, located ahead of these feed-gears, prevents any damage to the gears in case of overloads or accidents. These feed-gears, as well as those of the cutter-spindle gear-box, are of the quick-change type. The former spindle is connected with the feed by means of the starting clutch lever. It is driven through worm-gearing. The position of the clutch lever on the gear-box determines the forward and reverse movements of the work and former. The crank-handle which is employed for moving the work to and from the cutter is equipped with a micrometer dial that insures accurate settings for depth of cut. In operations on cast-iron cams, a blower mounted on the motor plate supplies air for cooling the cutter and keeping it free from chips. Lubricant is supplied by a pump when steel cams are being cut. A hose, nozzle, and catch-pan are furnished for such operations.

Through the provision of a one-horsepower motor on top of the cutter-slide, as shown in Fig. 2, and the replacement of a feed driving bracket in the rear by one especially adapted for grinding speeds, the machine can be arranged for grinding cams. These changes can be made in about thirty minutes. The grinding spindle is mounted in an arbor having a taper shank

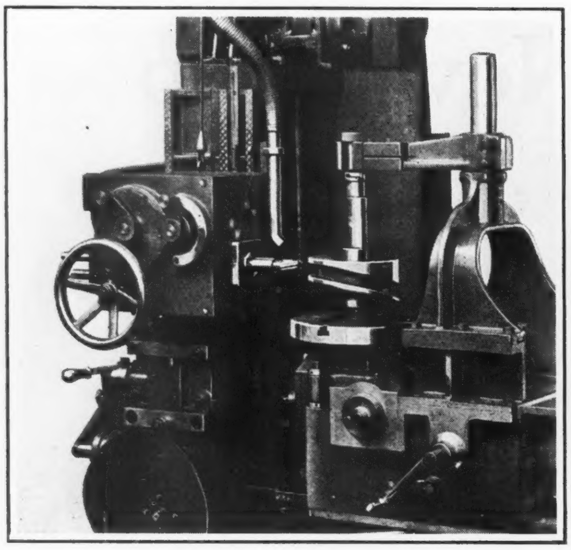


Fig. 1. The Spindle of the Rowbottom Cam Machine is Indexed to a Vertical Position for Side Cams

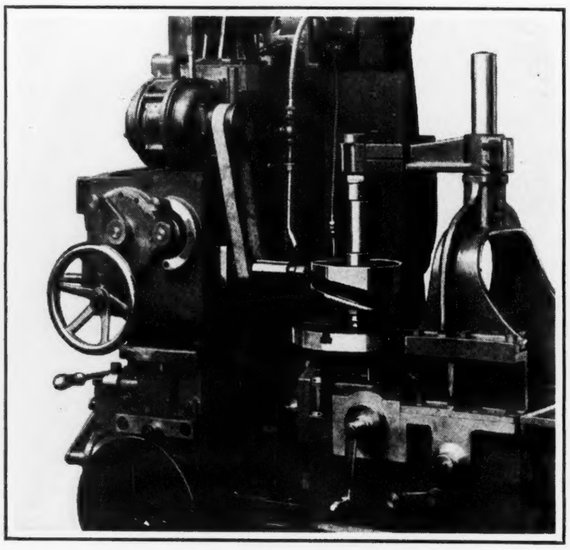


Fig. 2. Cams can be Ground by Providing a Separate Driving Bracket, Motor, and Grinding Spindle

that fits the cutter-spindle. The grinding spindle is driven direct by a belt as shown, the cutter-spindle being disengaged from its customary drive. The master former used in milling is also used for the grinding operation.

Natco Multiple Drilling and Tapping Machine

A Model D-5 machine of the multiple type is being placed on the market by the National Automatic Tool Co., Richmond, Ind. This machine can be used either as a drilling machine only, as a tapping machine only, or as a combination drilling and tapping machine. It has a capacity for driving ten 1/4-inch drills or ten 3/16-inch taps in mild steel.

The head has a drilling area of 5 1/2 by 10 inches. Although it is designed to receive ten spindles, any that are not needed can be omitted. All the spindles have a vertical adjustment of 1 1/4 inches to compensate for grinding the drills.

Standard spindles are reamed and threaded to receive Natco collets of new design for straight-shank drills and taps. These collets are bored for the specific size of drill or tap to be used. They have a three-point clamping action which centralizes the tool. A three-point wrench distributes the torque load in clamping, so that the collet jaws are not twisted out of round. The larger sizes of collets have a broached square for driving the tool.

An arm-type limit switch controls the point of tap reversal and insures accurate depths in tapping blind holes. The switch is mounted on an adjustable arm so that it can be located as close as possible to the tap, on the part being tapped. Proper spindle speeds are obtained by means of pick-off gears in the head.

Natco Multiple-spindle Machine for Drilling and Tapping

A special ball-bearing motor has been designed to withstand reversal loads without overheating. The one-horsepower motor is capable of making fifty reversals, or twenty-five complete working cycles per minute, while the two-horsepower motor is capable of making thirty reversals, or fifteen complete cycles per minute.

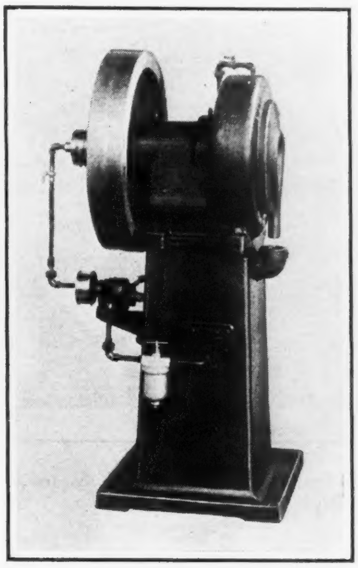
Langelier Swaging Machines with Timken Bearings

The spindle in a new line of swaging machines being introduced on the market by the Langelier Mfg. Co., Providence, R. I., is mounted in Timken roller bearings. The advantages claimed for this construction include reduced power consumption, decreased friction, and longer life of parts. It also gives close concentricity between the revolving spindle and the circle of head or retainer rolls. These bearings also permit the use of a much shorter and more rugged spindle.

The new line consists of eleven sizes of machines having capacities for work from 3/16 inch to

9 inches in diameter. The three largest machines, of 5, 7, and 9 inches maximum capacity, can also be furnished with plain bearings for the spindle if desired. In such a case, however, bronze bushings are supplied in the head and there is an outboard bearing with the flywheel mounted between the two.

All the machines of the line are provided with cabinet bases, having a large oil reservoir cast integral with the base for supplying lubricant to the head. A pump attached to the rear of the base forces the oil under pressure for lubricating and cooling the working parts. This pump is driven by belt from the spindle. A grease seal and flinger prevents the head lubricating oil from working into the spindle roller bearings. Grease is supplied to these bearings through two Alemite fittings. Several types and sizes of work-holding and feeding mechanisms are available for application to these machines.



Langelier Swaging Machine

Sundstrand Double-End Drilling and Centering Machine

The double-end drilling and centering machine here illustrated, which is a recent development of the Sundstrand Machine Tool Co., Rockford, Ill., is also suitable for reaming, spot-facing, and tapping. The right-hand head of the machine and both vises are adjustable longitudinally along the bed. The spindles can be operated either simultaneously or independently. The vises can also be operated independently by means of handwheels, or they can both be operated by one handwheel. Pneumatically operated vises can be furnished if desired.

The spindles are mounted in Timken bearings. Oil pockets between the bearings insure a liberal supply of lubricant. The spindles are regularly provided with a No. 3 Morse taper hole, and adapters can be supplied to accommodate No. 3 or No. 20 Jacobs chucks. A hole is drilled through each spindle to receive a draw-rod. The spindle quills are actuated by a rack and pinion, which provides a 4-inch independent movement or a 1 3/4-inch simultaneous movement.

There is a coolant tank of 10 gallons capacity in the right-hand leg of the machine. A pump capable of delivering 5 gallons per minute is mounted on this leg directly over the oil-pan.

The driving motor is mounted in the left-hand leg and regularly transmits the power through V-belts. Motors of from 1 to 5 horsepower are recommended. Four quick-change speeds ranging from 85 to 1800 revolutions per minute can be obtained through the use of a Westinghouse-Wise multi-speed drive.

This machine has a capacity for drilling two 1-inch holes in steel. It will accommodate work up to 6 inches in diameter. The maximum length of work that can be handled depends upon the size of the machine.

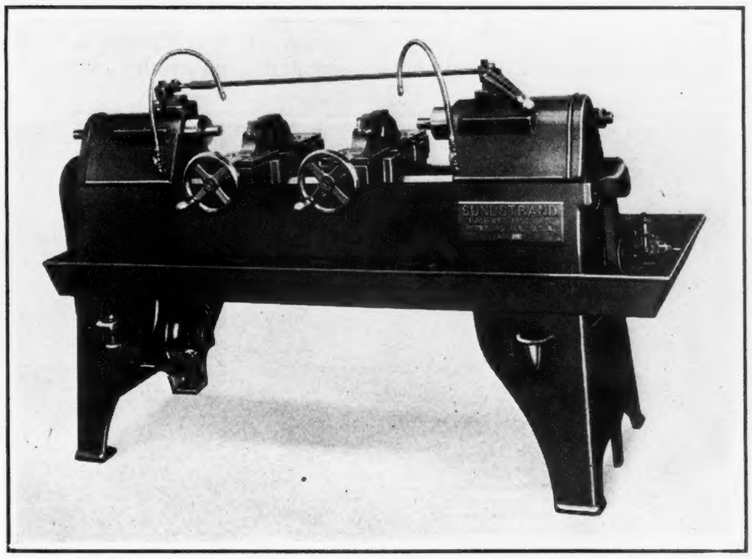


Fig. 1. Sundstrand Double-end Machine for Drilling, Centering, Reaming, Spot-facing or Tapping

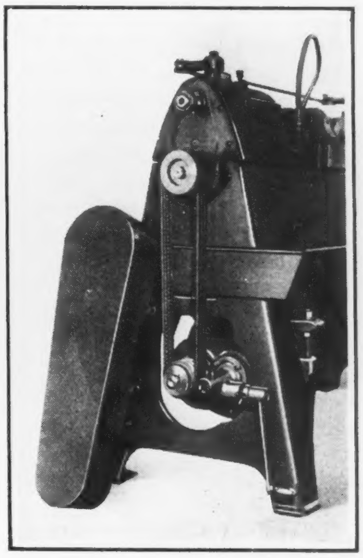


Fig. 2. A Westinghouse-Wise Drive Provides Four Speeds

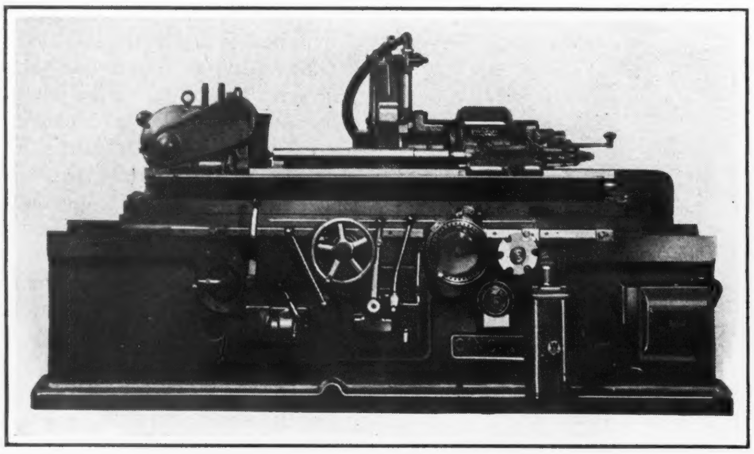


Fig. 1. Cincinnati Grinder with New In-feed Unit which Facilitates Grinding Shafts of Multiple Diameters

Semi-Automatic In-Feed for Cincinnati Grinders

A new semi-automatic in-feed recently developed by Cincinnati Grinders, Inc., Cincinnati, Ohio, permits the rough- and finish-grinding of cylindrical shafts having a multiple number of diameters with but one handling of the work. Fig. 1 shows this unit applied to a 14- by 48-inch plain, self-contained grinding machine. The in-feed unit is electrically and hydraulically controlled. It simplifies the operation of machines and reduces the human element and chances of error to a minimum. After the set-up and adjustments have been made, the unit requires little attention until a different size of shaft is to be ground. The setting up time for the six-diameter shaft seen in the machine in Fig. 1 was thirteen minutes.

This in-feed unit is located on the bed of the machine directly at the rear of the wheel-head in the manner shown in Fig. 2. In the unit there is a flat master cam made up of a series of steps, each of which corresponds to a diameter on the work to be ground. This cam controls the relative position of the wheel and the work. It is ground to very close limits so as to insure consistent clearance between the work and wheel.

The rear unit also contains six solenoid stops. These stops control the longitudinal travel of the master cam and bring the proper step in line with a positive block stop. This stop comes in contact with the cam step that represents the diameter of the work being ground.

A master drum switch with a star control wheel having six notches to suit this particular job is seen on the front of the machine in Fig. 1. This control wheel is indexed by station dogs as the table is traversed by hand. With each indexing, a corresponding contact point is closed in the master switch to actuate the respective solenoid stop. This stop limits the amount of cam travel to bring the proper step of the cam in line with the positive block stop.

As the cross-feed handwheel is given one-eighth turn counter-clockwise, a valve is opened to operate a piston that controls the cam bar. The wheel-head then travels rapidly toward the work until the positive block stop comes in contact with the proper cam step. This positions the grinding wheel approximately 1/64 inch from the work. From this point the wheel is fed to the work by the hand in-feed wheel.

By turning the cross-feed handwheel clockwise, the hydraulic valve is reversed and the wheel travels back to its original position. The rapid cross-feed of the wheel-head is approximately 1 1/4 inches. Accordingly, multiple-diameter work with no greater diameter variation than 2 inches can be ground. By removing all dogs from the table and setting the star-wheel drum switch so that the wheel-head in-feed movement will be controlled by a single cam, the machine can be employed for single-diameter work.

Carborundum Mounted Wheels and Points

A production set of mounted grinding wheels and points has been placed on the market by the Carborundum Co., Niagara Falls, N. Y., to handle the general run of grinding jobs performed by portable grinders. This set includes all the shapes and sizes and grits and grades required by

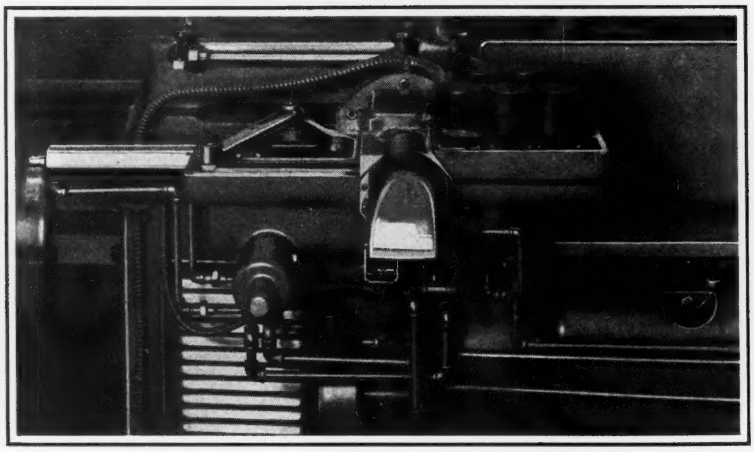


Fig. 2. View of the Semi-automatic In-feed Unit at the Rear of the Wheel-head

the average user. Each shape is designed not only from the viewpoint of being practical, but also to insure secure mounting on the mandrel or spindle. These wheels and points are made of Aloxite brand aluminum oxide and are mounted to run true. The spindles are copper-coated, a feature that not only insures a secure mounting, but also gives a rustproof spindle.

Included in this production set are two rubber-bonded polishing wheels that can be used for obtaining burnished surfaces on all metals without loading or filling. There is also a Carborundum brand dressing stick for general dressing or for changing the shapes of wheels to meet special conditions. All plain wheel shapes have a relieved end that permits the grinding of flat surfaces and blind holes. Two of the shapes can be used for die-grinding, for forming the teeth of special cutters, and for sharpening small circular tools.

The standard size copper-coated spindle is 1/8 inch in diameter by 1 1/8 inches long, but for certain types of grinders and flexible shaft machines, spindles 1/4 inch in diameter by 1 1/2 inches long can be supplied.

Rickert-Shafer Cutting-Off Machine

The tool-holders of a cutting-off machine recently developed by the Rickert-Shafer Co., Erie, Pa., are mounted on oscillating arms controlled by cams that are adjustable to permit any length of cut and any rate of feed. While the machine illustrated is tooled up for cutting off pipe nipples, it is easily adaptable for cutting off rods, tubing, etc.

For cutting pipe nipples, there is a V-type forming tool which takes the preliminary cut, after which a roller cutter mounted on the opposite side produces the chamfer on the end of the nipple and completes the operation. This roller cutter, which may be clearly seen in Fig. 2, saves considerable metal. The forming tool is mounted tangentially in relation to the work with a view to obtaining a free cutting action.

The work is fed through the hollow spindle by feed-rolls on the back end. These rolls are driven and controlled in such a way that they are in contact with the work for only a fraction of a second. As soon as the work strikes the stop and is gripped by the chuck, the rolls are pushed back by means of an automatically controlled sliding wedge.

A three-jaw push-in collet is employed for gripping the pipe, the draw-in rod being actuated by a revolving air cylinder on the rear of the spindle. The jaws of the collet are interchangeable to accommodate various diameters of pipe or tubing. To avoid heating of the revolving air cylinder, the cutting compound used for the tools is passed through a jacket which surrounds the airport housing on the cylinder. The operation of the air cylinder is controlled by cam-operated valves, adjustable to obtain accurate timing.

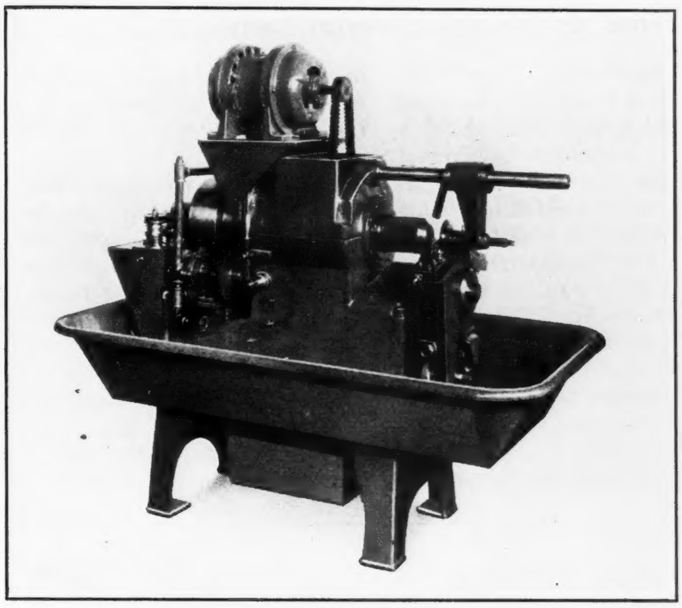


Fig. 1. Rickert-Shafer Cutting-off Machine with Tool-holders on Cam-controlled Oscillating Arms

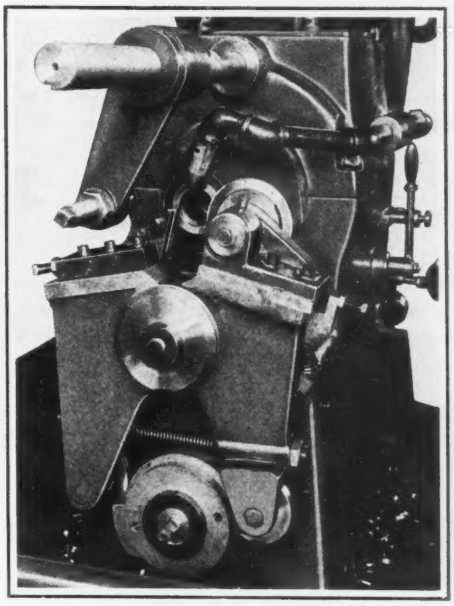


Fig. 2. A Roller Cutter Completes the Operation on Pipe Nipples

Bunting Babbitt Metal

A new babbitt metal with a lead base has been developed in the metallurgical laboratories of the Bunting Brass & Bronze Co., Toledo, Ohio, and is now being placed on the market. This babbitt has a Brinell hardness of about 24 at 70 degrees F., and about 12 at 210 degrees F. The melting point of the babbitt is

464 degrees F., while the pouring temperature is 625 degrees F.

One of the principal advantages claimed for this babbitt is an unusually low coefficient of friction. The metal is self-cleaning in that dust or grit getting into a bearing will sink into the babbitt, clear of the shaft. The babbitt pours freely, and therefore insures close fitting castings.

This babbitt is cast in bars weighing approximately 5 pounds each. The bars are of such a form that they can easily be divided into smaller portions. Ten bars are packed in a wooden box.

Norton Open-Side Surface Grinding Machine

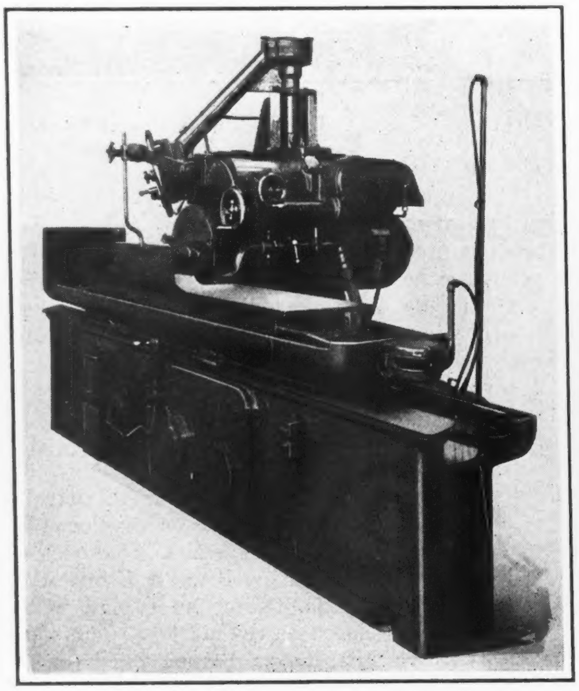
A new type of grinding-spindle drive is the principal feature of an improved 15- by 15-inch open-side surface grinding machine recently brought out by the Norton Co., Worcester, Mass. From the illustration it will be seen that the grinding-wheel slide is cylindrical at the rear end, and is bored to receive a standard motor field, which is pressed into place. The wheel-spindle carries a standard rotor which runs in the stator. The rating of this motor is 15 horsepower at 1200 revolutions per minute. The unit is air-cooled by a fan on the rear end of the spindle. This new arrangement eliminates the spindle pulley and countershaft formerly used, as well as three belts and a wheel-drive drum and pulleys. The spindle and rotor unit is carefully balanced, so as to run without vibration.

Other improvements in the machine include a 30 to 1 double worm reduction gear for the table drive, and a motor-driven "Fulflo" pump unit for the grinding lubricant. As in the former design, the table is driven by a reversing type of motor. It is coupled direct to the table-drive reduction gear, the final drive being a spur gear engaging with the table rack. The machine is designed for a 14- by 6- by 5-inch grinding wheel, and will be built in three lengths of 6, 8 and 10 feet.

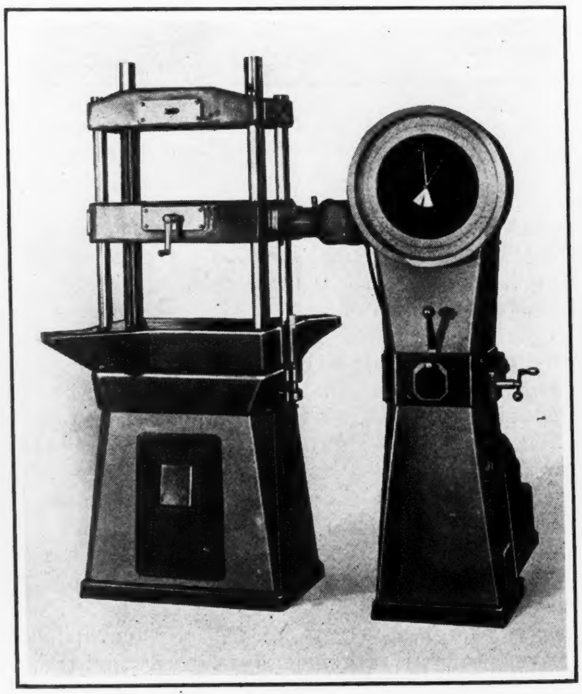
Riehle Hydraulic Universal Testing Machine

Wide application, sensitivity, and ease of operation are some of the advantages claimed for a precision hydraulic universal testing machine now being introduced on the market by Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. Standard tools can be supplied with this machine for making tension, compression, transverse, cold-bend, and Brinell tests. In addition, special tools can be provided for less common tests, such as ductility and shearing. The machine is designed to accommodate long or bulky specimens. It is built in five capacities ranging from 60,000 to 400,000 pounds.

The machine has three distinct units, the loading unit, the indicating unit, and the power unit. The loading unit has the customary upper and lower heads in which are located the grips used for tension testing. The upper head rests on four rods attached to the table, while the lower head is supported by two large screws set into the base of the machine. Bronze nuts in the lower head,



Norton Surface Grinding Machine, with Motor Field Assembled in Bore of Wheel-slide



Riehle Hydraulic Testing Machine Built in Capacities of from 60,000 to 400,000 Pounds

which are rotated by a motor and worm-gearing, provide for adjusting the head up or down. This drive is never used in making tests.

The table is supported on the hydraulic ram, which, together with its cylinder, is housed in the base. When hydraulic pressure is applied, the ram lifts the table and with it the upper head. As the lower head is stationary, a specimen gripped in the upper and lower heads will receive a tensile load, while one placed between the table and the lower head will be loaded in compression. A particular feature of the loading unit is that the grips move horizontally to engage the specimen. In closing the second set of grips, the hold of the first set is not released.

Hydraulic pressure from the main cylinder is brought to the weighing or indicating unit through a transfer valve, so that it can be applied, at the will of the operator, either on one plunger working singly or on two plungers working in opposition. The arrangement affords a direct means of obtaining full-scale load indications, either at full capacity or one-fifth capacity. Readings are obtained by means of a pointer which moves across the face of a 20-inch dial.

The power unit is located directly in back of the weighing unit and consists of a six-plunger variable-stroke high-speed pump driven by a constant-speed motor. The pump delivery is regulated by a cam, operated by levers on the front of the weighing unit.

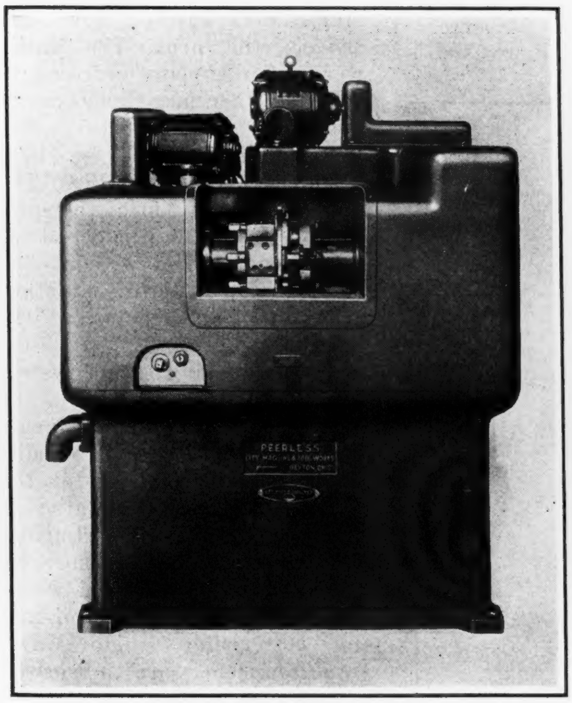
Peerless Burring Machine

The City Machine & Tool Works, E. 3rd and June Sts., Dayton, Ohio, has recently developed a special chamfering machine, known as the "Peerless," for removing burrs from automotive steering-gear sectors. The machine is shown in the accompanying illustration. The production on this machine approximates 460 sectors per hour. In operation, the turret rotates continuously, but at a variable speed. After the machine has once been set up, the operator merely has to load and unload the parts. The machine can be arranged to handle sectors with two, three, or four teeth.

Spiral-Gear Lead-Checking Fixture

The increased use of spiral gears in automobile transmissions has necessitated means of accurately checking either the lead or the spiral angle of these gears. The engineers of the Michigan Tool Co., 7171 Six Mile Road, East, Detroit, Mich., decided that it is preferable to check the lead rather than the angle, due to the fact that the lead is constant, whether measured at the root diameter, pitch diameter, or near the outside diameter. The angle of the spiral, on the other hand, changes in relation to the diameter of the gear.

Based on this conclusion, the concern mentioned has placed on the market the fixture here illustrated, which is intended for checking spiral gears up to 16 inches in diameter having a lead of 10 inches or over. Right- or left-hand spiral gears can be handled. The gear to be checked may be mounted on a stub arbor or placed between centers. The fixture is constructed on the sine-bar principle, similar to the fixture made by the same company



Peerless Machine for Removing Burrs from Steering-gear Sectors

Fixture Made by the Michigan Tool Co. for Checking the Lead of Spiral Gears

for checking the leads of hobs and worms, which was described in January MACHINERY, page 398.

After placing the gear to be checked in the fixture, the sine bar is set accurately at the proper angle for the lead in question by means of two measuring buttons. In checking, any error in the lead is registered on an indicator dial.

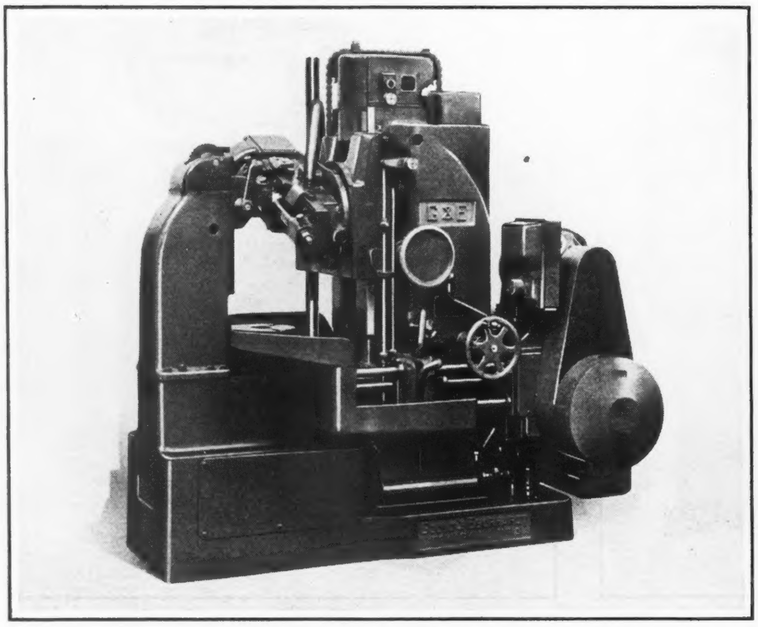
Gould & Eberhardt Universal Gear-Hobbing Machines

Two universal manufacturing-type hobbers, designated as the 12-H and the 12-H Heavy, have been added to the line built by Gould & Eberhardt, Newark (Irvington), N. J. These machines have been developed especially for the accurate production of the single helical and built-up herringbone gears used in silent and Synchro-Mesh automobile transmissions. They are also adapted, however, for other fields requiring fine-pitch and small-diameter gears.

Both machines have a capacity for cutting gears up to 12 inches in diameter with the support in place, and 18 inches with the support removed. However, the 12-H hobber is rated for cutting gears of 5 diametral pitch in steel and weighs 4600 pounds, whereas the 12-H Heavy is rated for cutting gears of 4 diametral pitch in steel and weighs 6600 pounds. The 12-H Heavy machine is shown in the accompanying illustration.

In common with all manufacturing hobbers built by this concern, these machines embody the vertical cutting principle, the cutter-slide being mounted on an adjustable stanchion and the work-spindle being located in a fixed position in the base. The hob slide travels on double rectangular guides, provided with independent adjustments. The swivel cutter-head has an angular adjustment of 180 degrees to permit cutting both right- and left-hand helical gears of any angle. To utilize the full length of the hobs, there is a positioning device for shifting the hobs axially.

A power rapid traverse moves the cutter rapidly in either direction. It can be operated with the work- and cutter-spindles idle or rotating. The traverse and feed controls are interlocked, so that one cannot be set in motion until the other has been disconnected. An adjustable cam stops the rapid approach, and a safety pin prevents accidental downward operation of the power traverse.



Gould & Eberhardt 12-H Heavy Universal Gear-hobbing Machine

The cycle of cutter movements comprises three phases—rapid approach, feed, and rapid reverse, each of which is automatically arrested at a predetermined point. The feeding motion automatically disengages the main clutch and stops the machine, but leaves the power traverse available. Adjustable stops govern the feed and traverse, and fixed safety stops control the extreme limits of motion of the cutter-head.

The work-table on the 12-H Heavy hobber is located fixedly in a large tapered bearing directly within the base casting, and is arranged with independent means of adjustment for maintaining the diameter and end fits of the spindles. The work-table on the 12-H machine is also located in a fixed position in the base, but it is mounted in Timken bearings. The work-arbor support is of a box type with an adjustable arm that can be locked in any position. A single lever adjusts, locks, and swivels the arm. The entire work-arbor support unit can be removed when large gears are to be cut.

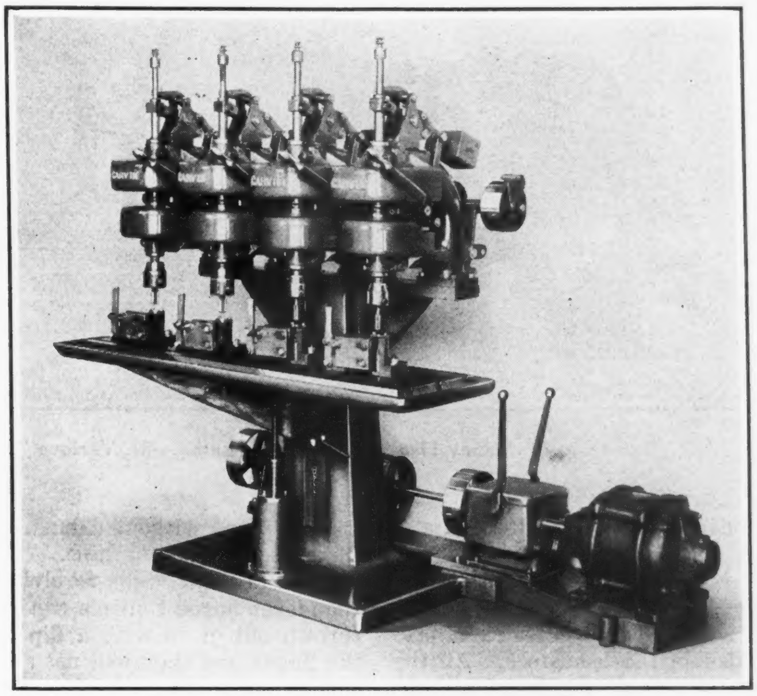
The cutter-spindle on both machines is adjustable. The diameter and end fit of the spindle can be adjusted independently and maintained without disturbing the setting of any other fit or without dismantling the machine.

A pressure lubrication system automatically supplies oil to the main mechanism in the gear-case and to the work-spindle. There is cascade oiling for the change-gears and they are enclosed in oil-tight compartments. The worm and worm-wheel drives to the cutter- and work-spindles are immersed in oil, and the cutter-slide guide ways, stanchion, etc., are lubricated by a gravity system. A separate pump and reservoir supply coolant to the hob.

Both machines are equipped with a single constant-speed driving pulley mounted on anti-friction bearings. Power is transmitted through a plate-type clutch arranged with a single convenient adjustment. A safety frictional slip-gear is interposed in the power traverse drive. Tubular belt guards that are adjustable for position are furnished.

The motor is direct-connected through either a belt or a silent chain. A constant-speed motor of 5 horsepower, running at 1200 revolutions per minute, is recommended for the 12-H machine, and a 7 1/2-horsepower motor for the 12-H Heavy machine.

These gear-hobbing machines can be supplied with full equipment for cutting a diversified range of spur and helical gears or with limited equipment for cutting one specific gear only. An automatic in-feed mechanism for hobbing worm-wheels is available.



Garvin Tapping Machine which can be Used for Tapping Four Holes of Different Sizes

Universal Standardized Jig Bushings

A new series of drill bushings made to the American Standard Association's specifications has been brought out by the Universal Engineering Co., Frankenmuth, Mich. The standardization of these drill bushings was sponsored by the National Machine Tool Builders' Association, the Society of Automotive Engineers, and the American Society of Mechanical Engineers.

The new series consists of seven body diameters and three lengths. The bushings are manufactured with a screw lock on the head and the "Universal" ball lock on the body. This dual locking arrangement permits the user to employ whichever type of locking arrangement is most convenient.

All bushings of this series are made of Nitralloy. It is claimed that drill bushings made of this material, by actual tests under manufacturing conditions, have shown from three to four times the life of ordinary tool-steel bushings.

Garvin Four-Head Automatic Tapping Machine

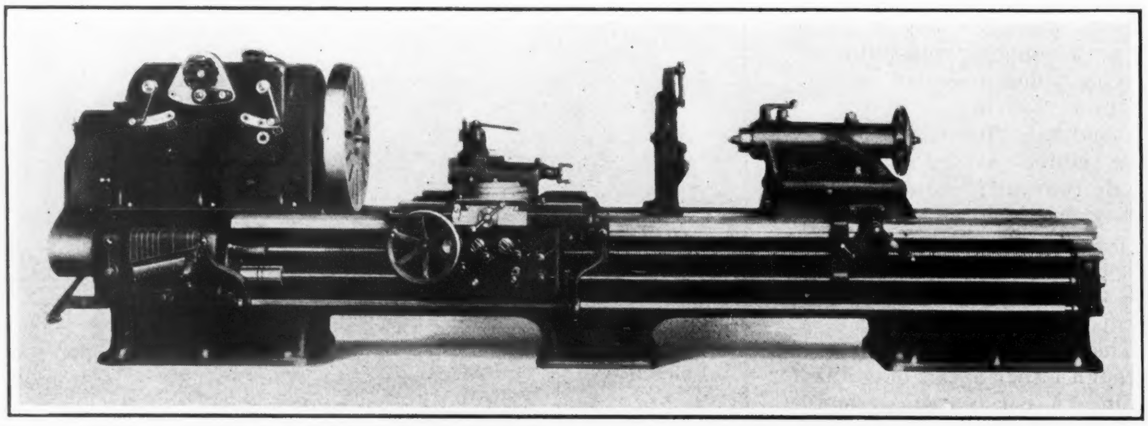
A four-head No. 2-X machine equipped with Timken tapered roller bearings has been added to the line of Garvin automatic tapping machines built by the Western Machine Tool Works, Holland, Mich. This equipment can be used for rapidly tapping holes of four different sizes. The machine illustrated is provided with a four-change speed-box and is used for tapping steering knuckles. The jigs employed in connection with this operation are shown clamped to the table. One of the heads is arranged for a left-hand drive. Each of the heads has a capacity for driving a 7/8-inch tap in cast iron or a 3/4-inch tap in steel. The pipe tap capacity is 1/2 inch in cast iron and 3/8 inch in steel.

All the moving parts of this machine are mounted in Timken tapered roller bearings. While the machine is designed for operation at the highest speeds, it is sensitive enough to prevent the breakage of taps. After the operator has pulled the starting lever until the tap is engaged in the work, the machine automatically finishes the operation, tapping to a predetermined depth.

Tritrol Heavy-Duty Engine Lathes

The thirty- and thirty-six-inch heavy-duty engine lathes recently brought out by the Sidney Machine Tool Co., Sidney, Ohio, are equipped with a "Tritrol" direct-reading, sixteen-speed control. Other features include a totally enclosed anti-friction self-oiling gear-box, anti-friction end gearing, and an anti-friction centrally oiled apron.

Attention is called to the method of guiding and holding the carriage to the bed. At the front and back, the carriage is guided by large vees, while a wide flat bearing supports it under the bridge where the tool pressure comes. Gibs are located in the center of the bed on square guides in order to keep the carriage from being lifted



Sidney Heavy-duty Engine Lathe with Various "Tritrol" Features

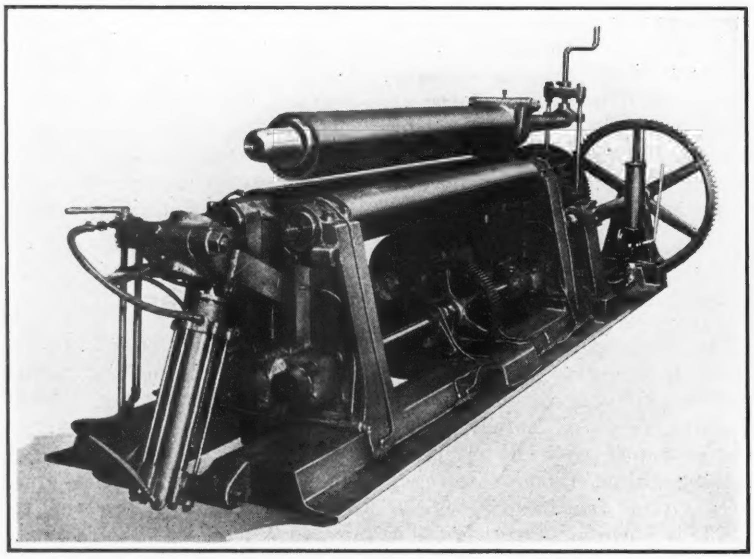
under the heaviest cuts, and also to strengthen the bridge. The bed is of four-walled construction.

Herringbone gears are provided in the headstock. All the anti-friction bearings in the headstock are adjustable from the outside without removing the cover. The Tritrol positive-jaw clutch, together with the herringbone gears, permits sudden changes to be made in the spindle speed without damaging the work, tool, or machine.

The Tritrol non-revolving snap-lever apron controls can be thrown out or in with a flip of the finger, yet they will not slip out of engagement under the heaviest loads. A lever on the apron provides a reverse to all feeds without reversing the spindle. Joseph T. Ryerson & Son, Inc., Chicago, Ill., is the general distributor for these lathes.

Cleveland Pyramid-Type Bending Roll

Cylinders of small diameter can be produced from heavy material in a pyramid-type bending roll recently built by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. In the illustration, a shell 8 inches in diameter is seen on the top roll used in shaping it, which is of slightly smaller diameter than the shell. After this cylinder was formed, a straightedge showed a deflection of less than 1/32 inch for the entire length.



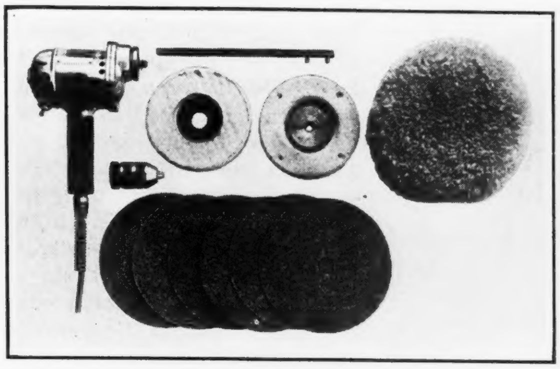
Cleveland Bending Roll which Produces Small-diameter Shells from Heavy Material

One of the important features of this bending roll is the provision of an air-operated hinge which allows the cylinder to be conveniently removed from the top roll. There is an individual motor drive for operating the rolls and for raising and lowering the top roll. All the bearings on the machine are lubricated by a single-shot system. None of the machine parts extends below the floor level.

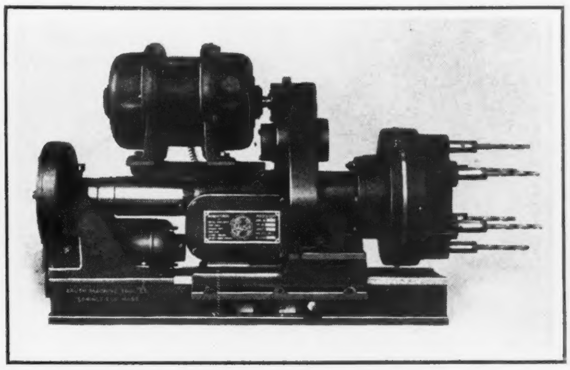
Electric Four-in-One Portable Tool

A portable electric tool that can be used as a drill, sander, buffer, and polisher is being introduced on the market by the United States Electrical Tool Co., 2477 W. 6th St., Cincinnati, Ohio. This tool is shown in the accompanying illustration, together with the various accessories. Drills, wire brushes, abrasive wheels, rasps, etc., are held by the keyless chuck, while the 5-inch flexible pad accommodates sanding disks, lamb's wool polishing bonnets, and felt rubbing pads. The motor is of the universal type, operating on either alternating or direct current of 110 or 220 volts.

The same company has also recently brought out a ball-



Combination Tool Made by U. S. Electrical Tool Co., with its Accessories



Baush All-electric Drill Unit, which has a Screw and Nut Feed in the Center

bearing equipped machine intended principally for polishing golf clubs. The shaft or spindle of this machine is 30 inches long, providing 6 inches of space between each wheel and the motor, which is ample for polishing all parts of the clubs.

Baush All-Electric Center-Feed Drill Unit

An electric drilling unit that can be mounted on machines singly or in multiple and in horizontal or vertical positions for various operations such as drilling, reaming, spot-facing, or boring has been brought out by the Baush Machine Tool Co., Springfield, Mass. This unit can also be arranged for tapping. The head has a quick forward motion; a positive and powerful center feed; and a quick return to the starting position. All these head movements are automatic and yet are under the control of the operator by means of a four-button station. The buttons of this station may be used to stop, start, "inch" forward or backward, or reverse the head travel in either direction while the machine is running.

The three-horsepower motor which drives the main spindle through spur gearing can operate a single drill or multiple drilling heads. The drilling speed can be varied by changing two gears, and the feed can be varied by changing two other gears.

Feeding of the head is accomplished by the rotation of a nut on a screw directly in the center of the drilling area, this being a patented feature. The head can also be operated manually for adjusting the tools by applying a crank to one end of the screw. The quick approach and return of the head are accomplished by using an entirely separate motor which operates the screw instead of the nut. All switches and electric coils are contained in a drawer which is easily pulled out for inspection.

LeBlond Automatic Facing and Forming Machine

A special high-production lathe designed for rough- and finish-facing or rough- and finish-forming has recently been built by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. In the illustrations this machine is shown tooled for forming ball joints on automobile transmission shifter levers.

A wide variation of feeds can be obtained instantly by merely shifting two levers. From the gear-box, power is transmitted to a cam-drum through gearing which gives a reduction of 10 to 1. The cam acts directly on a roller mounted on the lower side of the cross-slide. The advantages claimed for this construc-

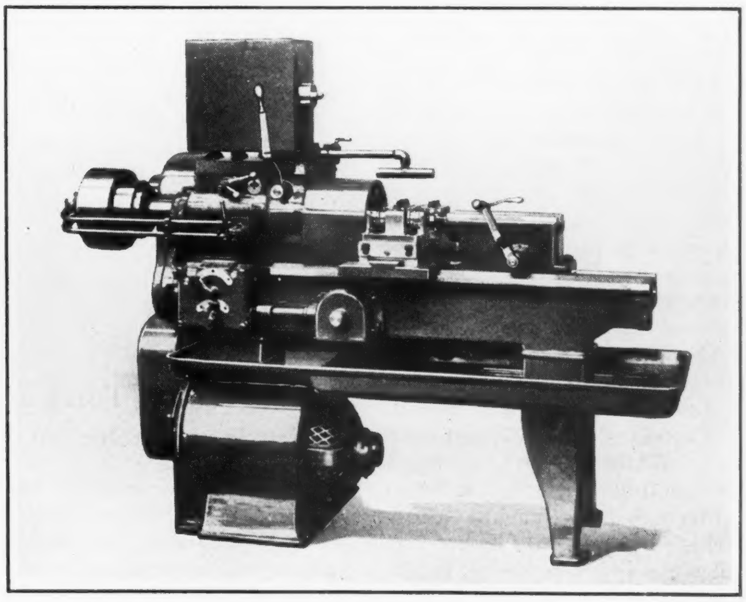


Fig. 1. Le Blond Automatic Lathe Designed for Rough and Finish Facing or Forming Operations

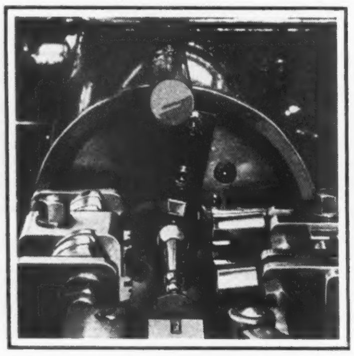


Fig. 2. Tooling for Forming the Ball Joints of Transmission Levers

tion are simplicity and the elimination of lost motion. The cam-drum operates in a bath of oil.

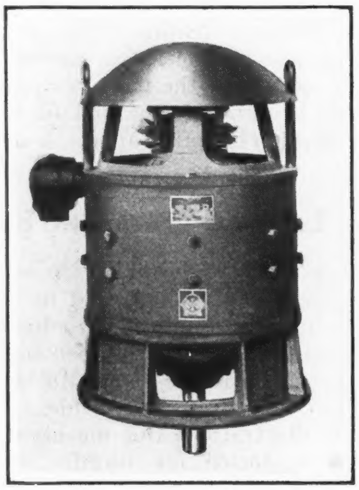
The machine is automatic in its cycle of operations, the only duties of the operator being to load and unload the work and to press the spindle starting lever on the headstock. The tool-slide is then automatically traversed to the cutting position of the rough-forming tools, after which the rough-forming cut is taken at a suitable feed. Next the tool-slide is automatically traversed to the cutting position for the finish-forming tools. At this point, a cam actuates a switch which shunts out part of the resistance in the shunt field circuit of the driving motor so as to reduce the spindle speed. The machine then takes a very light finish-forming cut. When this cut has been completed, another cam operates the electrical equipment which causes the spindle to run at the normal rate. The tool-slide is finally traversed to the loading position and a dog on the cam-drum automatically stops the spindle and the flow of coolant.

The geared head of this machine gives six spindle speeds up to 1000 revolutions per minute. It is equipped with Timken bearings. While a lever-operated, quick-acting, cut-away tailstock is illustrated, the machine can be furnished with a barrel-type tailstock, either lever- or screw-operated.

This machine is also applicable for such work as the rough- and finish-grooving of automobile pistons and the forming of ball-crank handles.

Reliance Direct-Current Vertical Motors

Direct-current motors designed for vertical operation have been developed in sizes up to 50 horsepower by the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio. These motors are provided with a ring base for convenience in mounting, although they can be connected directly to the machine to be driven without the ring base, so as to look like an integral part of the machine.



Vertical Motor Made in Sizes up to 50 Horsepower

A cover protects the motor from falling dirt or chips and from dripping water, oil, etc. Large bearings take up the thrust load and weight of the armature. Two heavy eyebolts facilitate handling.

Purox Welding Torch and Cutting Attachment

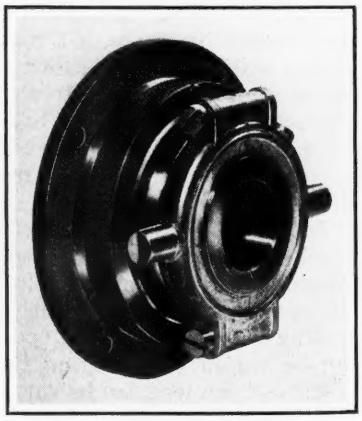
Two additions recently made to the line of Purox medium-pressure oxy-acetylene welding and cutting apparatus manufactured by the Linde Air Products Co., 30 E. 42nd St., New York City, comprise a No. 11 welding torch and a No. 21 cutting attachment. The new welding torch, which supersedes the Purox No. 10 torch, has a range extending from the lightest sheet metal up to work as heavy as 1/2-inch plate. Even with this wide range, the torch is light in weight. The tips are so designed that the head can be easily adjusted for angular position.

The cutting attachment is designed for use with the new torch and will cut metal up to 2 inches in thickness. By means of an adapter, the attachment can also be applied to the Purox No. 20 welding torch. It weighs only 1 pound 8 ounces.

Twin-Disc Clutch for Fractional-Horsepower Motors

A clutch designed for use in small high-speed installations requiring a compact unit has been placed on the market by the Twin Disc Clutch Co., Racine, Wis. The parts of this clutch, one type of which is illustrated, are designed to interlock in such a manner that cotter-pins or similar fastenings are unnecessary. The levers are housed within the nut structure, the construction being similar to the machine-tool type of clutch made by the concern. The levers are operated by a cone of internal form. Adjustment of the clutch consists merely of screwing or unscrewing a ring.

The clutch is made in a dry



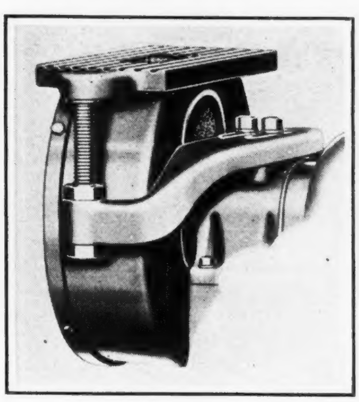
Twin Disc Clutch for Small High-speed Installations

plate form with a single driving plate which may be bolted to the driving member. The clutch may be driven by round pins or by gear teeth cut in the periphery for driving from an internal gear-ring. There is also a type designed for use in an oil spray. This type has two bronze disks and one steel disk in place of the dry plate.

The internal cone may be operated by the usual collar having trunnions or by means of a handwheel. Trunnion blocks can also be furnished for use with an operating fork when the clutch is used in an oil spray. This clutch is intended for use in conjunction with fractional-horsepower motors on various kinds of machines and appliances.

Hisey Surface Grinding Attachment

A surface grinding attachment that is interchangeable with the standard wheel-guard equipment of grinders built by the Hisey-Wolf Machine Co., Cincinnati, Ohio, has been brought out by the same company. This attachment can be mounted on either the right- or left-hand side of a machine in the manner illustrated. The table is adjustable to suit the wear of the wheel by square-thread screws which are locked in place by means of opposed nuts. The guard cover is easily removed for replacing the wheel. The table measures 10 by 21 inches, and is self-cleaning.



Surface Grinding Attachment Applicable to Hisey Grinders

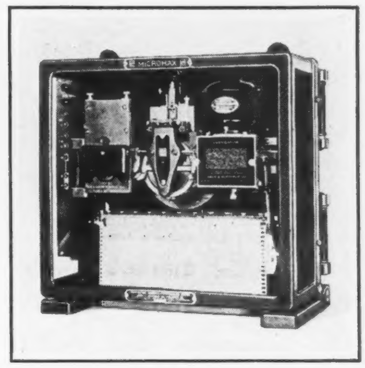
Comparator for Checking Steel Balls

The Micro-Indicator stand produced by the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, which was described in June MACHINERY, page 812, is now available with equipment for checking the diameter and roundness of steel balls. The illustration shows the instrument arranged for such work. It is being placed on the market in the United States and Canada by the R. Y. Ferner Co., Investment Bldg., Washington, D. C.

Micro-Indicator Stand Arranged for Checking Steel Balls

In this application, a small pin fastened under the front edge of the base holds the stand slightly tilted to permit the balls to roll down a V-block to an adjustable stop. The Micro-Indicator is provided with a lifting clip by which the contact plunger can be raised to allow the ball to take its proper position, after which the plunger is lowered for the measurement. The adjustable tolerance marks of the device can be set at any point within a range of 0.003 inch each side of the center.

Since the balls are ejected at the rear of the V-block, their inspection can be performed practically as fast as the balls can be fed. Balls between 1/8 and 5/8 inch can be accommodated.



"Micromax" Potentiometer Pyrometer, Made by the Leeds & Northrup Co.

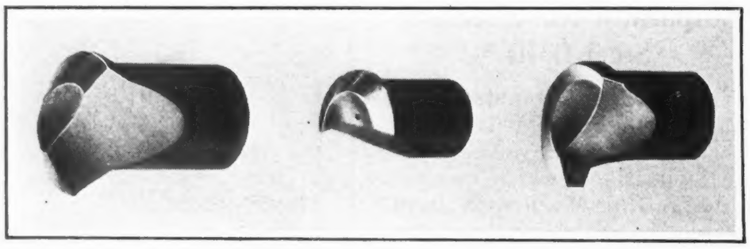
Micromax Improved Potentiometer Pyrometer

An improved potentiometer pyrometer, which is being placed on the market by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., has been given the name of "Micromax" to distinguish it from the preceding model made by the company since 1910. The new pyrometer is more sensitive, more rugged, and faster in operation than the previous model. It is fully automatic, so that daily attention or adjustment is eliminated. These advantages are obtained by a new mechanical balancing device and an automatic standardizer which checks the instrument circuit every forty-five minutes or less. Leeds & Northrup recorders now in use may be equipped with these improvements.

Owing to the elimination of operating clearance between the galvanometer pointer and levers, pointer deflections as small as 0.001 inch can be detected and recorded. Also, the recording pen can move across the entire 9 7/8 inches of calibrated chart in less than twenty-two seconds. Indicating, recording, and controlling models of the new pyrometer are available.

Amsco Nickel-Manganese Steel Welding Rod

The American Manganese Steel Co., Inc., Chicago Heights, Ill., has brought out a new



Fanger Tool Tips of a Circular Form that Facilitates Resharpening

nickel-manganese steel welding rod based upon a patent issued to Frank A. Fahrenwald, research engineer of the company. The following advantages are claimed for this welding rod: Excellent welds can be made by relatively unskilled operators; when the rod is melted in the atmosphere and applied to ferrous metal articles, it exhibits the essential characteristics of heat-treated manganese steel—toughness, ductility, resistance to abrasion, and ability to harden under cold working; and the high nickel content (approximately 5 per cent) overcomes any tendency of the metallic manganese content of the rod to oxidize and prevents the metal from becoming brittle from the slow cooling.

The preferred formula for the composition of the welding rod designated in the patent is manganese, 14 per cent; carbon, 1.30 per cent; nickel, 5 per cent; silicon, 0.35 per cent; and the remainder iron. The patent claims, however, cover a broad range of the principal elements.

Fanger Single-Point Boring Tools

Typical examples of a line of Fanger single-point boring tools, now being placed on the market by the Bochum Tool Co., P. O. Box 32, Northwest Station, Detroit, Mich., are shown in the accompanying illustration. These cutters are of a circular form which enables them to be quickly reground by unskilled help. Long life is another important advantage of this construction, because the tools can be used until practically the entire form has been ground away.

These tools can be furnished for machining holes from 1/8 inch in diameter up to 2 inches in diameter or larger. In the illustration, plain boring tips are shown at the left and the middle, while a bottoming and facing tool is seen at the right.

Niagara Drum-Making Equipment

The Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., have recently built the equipment illustrated for manufacturing the bodies of sheet-steel drums having a compound side seam by straight-line production methods. The outfit consists of three machines, a motor-driven conveyor, and a ramp. This equipment gives a production of five or more drum bodies per minute.

Four corners of the body blank are notched at one time by the notching unit at the left. The blank is then carried by the conveyor to the forming roll in the center, where the blank is formed into a cylinder. When discharged from this machine, it rolls to a stop at the end of the ramp. One stroke of the press at the right produces channel-shaped formations near the adjacent edges. Then the seam is closed as the blank passes through the attachment mounted on the right-hand housing of the press. From this attachment the drum body is discharged on a horn ready for removal. Fig. 2 shows the successive stages in forming the compound seam.

The notching unit consists of two gap presses, one of which is stationary, while the other is adjustable for increasing or decreasing the distance between them to suit the length of the body blank. The notching dies are also adjustable for height.

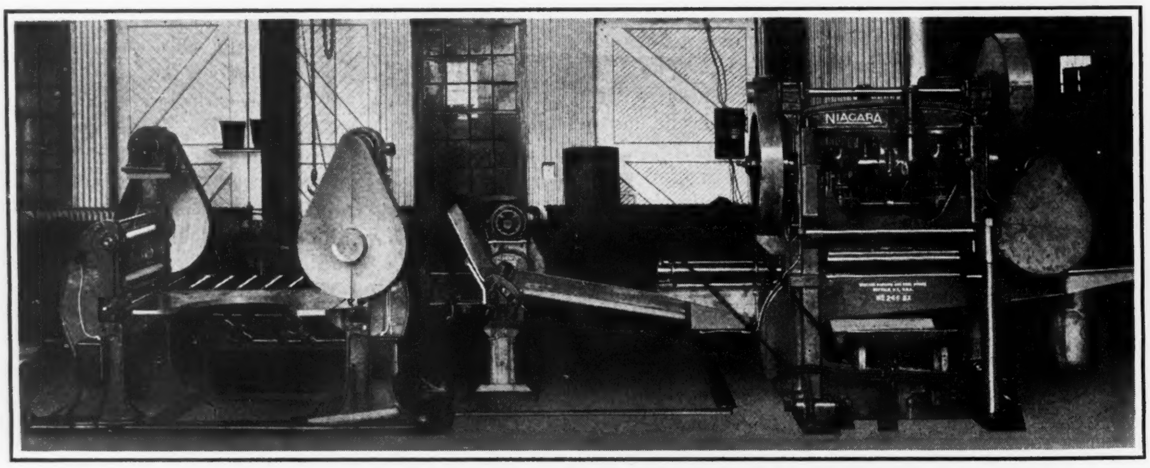


Fig. 1. Equipment for Producing Drums with a Compound Side Seam

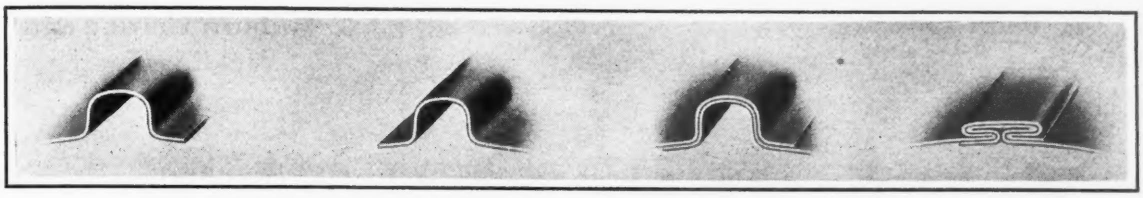


Fig. 2. Successive Steps in Forming the Compound Side Seam of Drum Bodies

Gages locate the sheet accurately. One treadle trips both presses. The forming roll is of the slip-roll former type, and the body seaming press is of the double-crank type. The seam-closing attachment employs four rolls for finishing the seam, and automatically feeds the drum body to the discharging point.

Chard Twelve-Speed Lathe

The four highest speeds of the Chard multi-speed lathe here illustrated, which has recently been placed on the market by the Western Machine Tool Works, Holland, Mich., are transmitted direct to the spindle without using any gears in the headstock. Power is transmitted from the lower shaft of the speed-box to the spindle either by a silent chain or Texropes. Three selective speeds are also available in the headstock, making a total of twelve speeds. This lathe is built in engine and manufacturing types.

The speed-box is of the automobile-shift type, and all the shafts run in ball bearings. The driving gear or pulley runs on a bearing which is a part of the speed-box unit itself, thus relieving the drive shaft of strains. The speed-box is cast integral with the left-hand leg of the machine. Instantaneous start and stop levers are located conveniently on both the headstock and the apron.

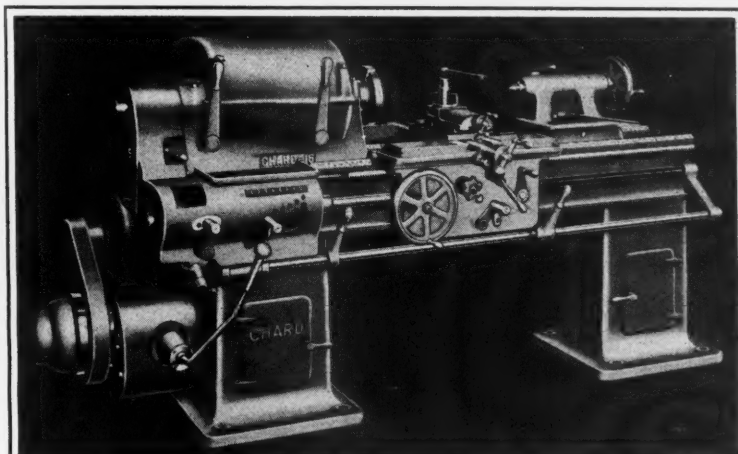
Multi-speed lathes are built in 16-, 18-, and 20-inch sizes by this company. Four- and eight-speed types, in addition to the twelve-speed type, are available, as well as a single-purpose machine that may have any speed up to 2000 revolutions per minute.

The spindle of the multi-speed headstock runs in four precision-type Timken tapered roller bearings. End thrust is taken by the front bearing. The rear bearing is of the floating type. The spindle and back-gear shafts are made hollow to provide for the constant oiling of all moving parts. Oil is supplied from the inside of the shafts by centrifugal force.

The same company has also brought out a new cone head for engine or manufacturing types of lathes, which is equipped with Timken roller bearings. This headstock is provided with a back-gear and has a quick start and stop arrangement by means of a clutch mounted directly on the spindle and a brake which has a positive and instantaneous action. These features eliminate the need of a countershaft.

The cone pulley is mounted to run freely on a sleeve instead of on the spindle. A sleeve mounted on the spindle passes through the cone pulley. When the brake-shoes are applied to a tapered flange on this sleeve, the sleeve instantly stops rotating.

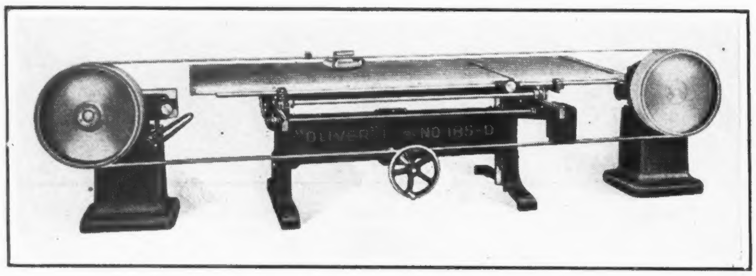
A back facing rest, also made by this company, enables facing, necking, grooving, and squaring operations to be performed simultaneously with the taking of turning cuts by one or more tools. These cuts are taken as a top slide on the facing rest is moved either forward or backward when the carriage is fed along the bed in either direction. The movement of the top slide is effected by the engagement of a rack on the back of the carriage with a pinion on the bracket of the back facing rest. An automatic stop makes it possible to stop either the back facing slide or the carriage at desired points, or both of them simultaneously. This feature enables one man to operate several lathes at a time.



Chard Multi-speed Lathe Recently Brought Out by the Western Machine Tool Works

Oliver Belt Sander

The Oliver Machinery Co., Grand Rapids, Mich., has brought out a motor-driven belt sander in which the columns or stands



Oliver Belt Sander for Metal and Wood Parts

that carry the belt pulleys can be placed any desired distance apart. One of the stands has a motor-driven pulley, while the other is of an idler type. The pulleys are solid aluminum and have rubber facings. The sanding belt is reversible.

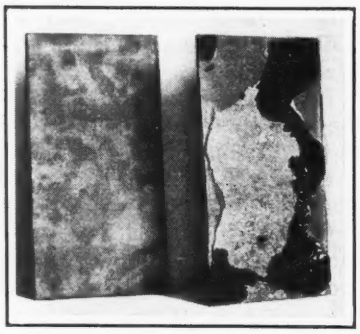
The table is 32 inches wide by 96 inches long. It rolls from front to back on ball bearings and is adjustable vertically a distance of 14 inches.

This machine was developed for sanding not only wood, but also sheet steel, aluminum, bronze, brass, and other metals. Special attachments are available; for instance, the machine has been fitted up for sanding automobile fenders.

Plykrome—A Composite Steel with a Stainless Surface

Industrial Welded Alloys, Inc., 225 Broadway, New York City, has completed a research that has resulted in the development of a composite metal known as Plykrome in which a veneer of stainless steel is "weld-bonded" to a slab of mild steel and then rolled in a mill into an integral plate or sheet. The stainless alloy component may consist of Nirosta, Rezistal, Nichrome, Allegheny metal, Hastelloy, etc. This composite metal can be made with the stainless ply on one side or on both sides.

Physical tests have demonstrated that this new metal can be bent, drawn, spun, or flanged without cracking or without parting the alloy from the mild steel. In an oxidation test the alloy was unaffected, there being no oxidation, blisters, surface cracks, or parting of the weld, even though the mild steel backing oxidized and flaked away. This test consisted of exposing a piece of Plykrome in a gas-fired furnace to a temperature of 1600



The Alloy and Mild Steel Surfaces of Plykrome after Oxidation Test

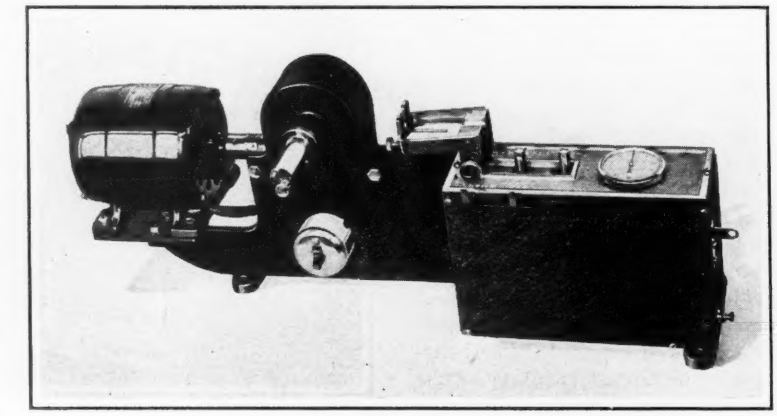
degrees F. for a period of weeks, alternately heating and cooling. At the left in the illustration is shown the stainless ply side as it appeared at the end of the test, and at the right may be seen the mild steel backing. The ratio of alloy thickness to that of the plate can be anything desired.

Milburn Cutting and Welding Torch

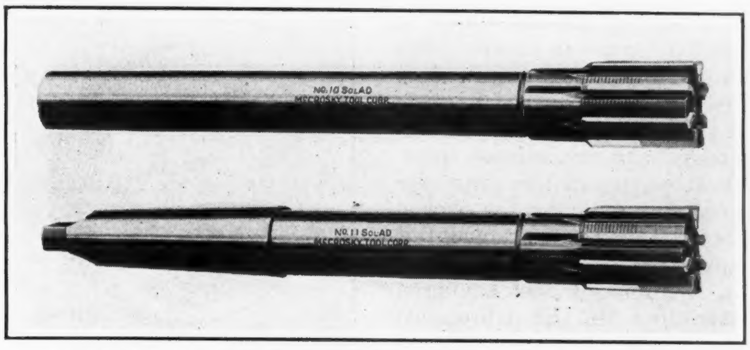
The conical-seated tips of a new cutting and welding torch which is being placed on the market by the Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md., are interchangeable on torches of other makes. The principal parts of this RIF-A torch are made of forged bronze, while the tubes are nickel-silver. There is a patented leak-proof, high-pressure valve which is readily accessible. The seats of this valve can be renewed without disassembling the handle or other parts. This device can be immediately converted from a cutting torch into a welding torch by the use of an adapter.

Dynamometer for Wire-Drawing Dies

A Triplex dynamometer for indicating the force required to draw wire through diamond dies has been placed on the market by Robert Miller, 221 N. 23rd St., Philadelphia, Pa. This device also indicates the ultimate breaking point of the wire. It has three scales, the first of which gives readings in hundredths of a pound from zero to one pound, so as to enable accurate tests to be made on the smallest die sizes. The other two scales range from 0 to 10 pounds and from 0 to 100 pounds. The instrument is 25 inches long by 8 1/2 inches high and weighs 38 pounds.



Dynamometer which Shows the Force Required to Draw Wire through Diamond Dies


"SolAD" Adjustable Reamers with Straight and Taper Shanks

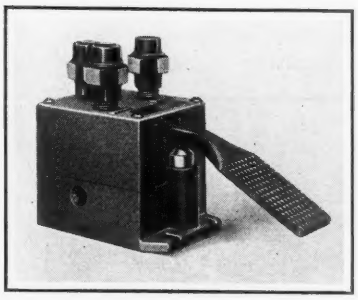
McCrosky Adjustable Reamers

Adjustable reamers recently introduced on the market by the McCrosky Tool Corporation, Meadville, Pa., under the trade name of "SolAD" are shown in the accompanying illustration. The high-speed steel blades of these reamers are held in slots in an alloy steel body by peening the body metal around the blades. A ground shoulder on each blade just below the body diameter provides an extra hold for the peened metal. This shoulder is on the cutting side of the blade, so that the peening process forces the blade against the bottom and back of the slot.

The bottom of each blade is beveled crosswise, and the bottom of the slot is milled correspondingly, so as to give increased strength to the body cross-section and enable the maximum number of blades to be used. This design permits inserted-blade reamers of unusually small sizes.

The body slots are milled longitudinally at an angle that rises toward the front end, and the bottoms of the blades have a complementary angle. Adjustment of the blades forward to compensate for wear and regrinding is effected by using a drift. The blade cutting edges are always ahead of the reamer body. The maximum adjustment ranges from 0.052 to 0.131 inch, according to size.

Standard machine reamers of the "SolAD" design vary in thirty-seconds of an inch from 3/4 to 1 1/4 inches in diameter, and in sixteenths of an inch up to 2 inches. Intermediate and decimal sizes can be furnished to order.


Logan Foot-controlled Valve, the Pedal of which is Returned by Air

Logan Foot-Controlled Air Valve

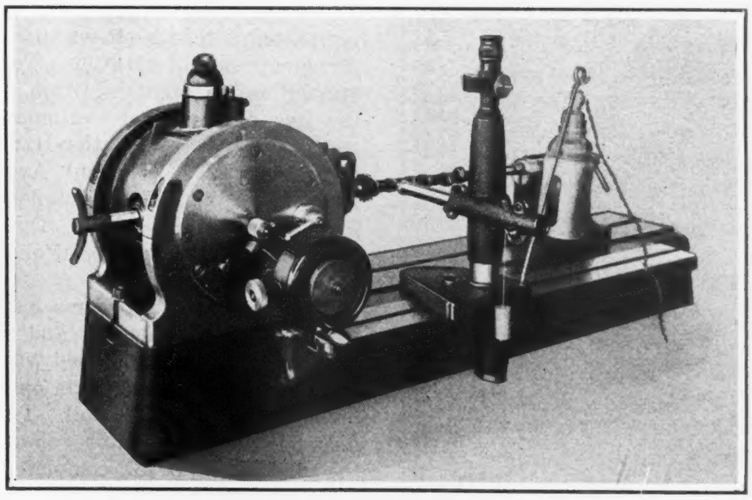
A foot-controlled air valve of a single-pedal reversing type is being introduced to the trade by the Logansport Machine Co., Logansport, Ind. A small air piston located under the foot-pedal automatically returns the pedal and reverses the valve when the operator's foot is removed.

The pedal has been designed to conform with the natural position of the operator's foot, and it is not necessary for the operator to raise his foot from the floor to operate the pedal. The valve is regularly manufactured in 3/8-, 1/2-, 3/4-, and 1-inch pipe sizes.

Optical Cam-Checking Device

An optical device for checking the cams of automobile camshafts, etc., has been added to the line of Zeiss instruments marketed by the George Scherr Co., 128 Lafayette St., New York City. With the camshaft held between the centers of an optical dividing head and tailstock as illustrated, the angular setting of the cam is readily determined by means of the dividing head. Readings are given direct to 1 minute, and they can be accurately estimated to 20 seconds by eye. It is claimed that the accuracy of the dividing head is such that errors in determining the angular setting will not exceed 5 seconds.

The rise and fall of the cams for each angular setting is checked by means of a measur-


Optical Device for Checking Automotive Camshafts

ing microscope which has a scale embedded in a plunger that moves freely in and out in triple roller bearings. This plunger is so adjusted that it travels in a plane parallel with the axis of the centers and also parallel with the surface plate. It is brought into contact with the cams by means of anvils having the same shape as the valve stem heads to be used with the cams. The scale on the plunger is graduated to 0.05 inch, and this graduation is divided by means of a spiral micrometer ocular to 0.00005 inch. After one cam has been checked, the measuring microscope is moved to the next one and clamped in position for the readings.

Jay Tee Screw Extractors

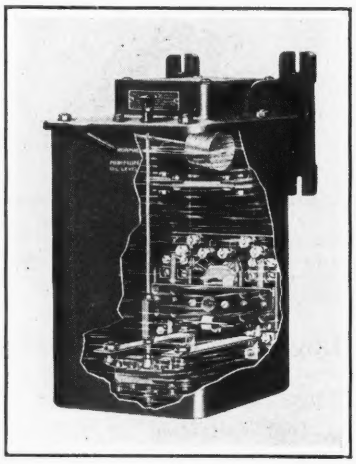
The Jackman Tool Co., Inc., 5209 Baum Blvd., Pittsburgh, Pa., has brought out a line of screw extractors embodying patented features which make it possible to take out the end of a broken stud or bolt, no matter how deep in a cylinder block or other part, without removing or loosening other bolts. There is a specific size of extractor and a corresponding drill and drill gage for each size of bolt from 1/4 to 3 inches in diameter. Two standard lengths of extractors are available, one of which is intended for use in shallow holes and the other for use in deep holes.

Using the Jay Tee Screw Extractor

Extractors are also made for standard and extra heavy pipe, and there is another tool designed for removing the broken ends of Alemite, Zerk, and Dot grease connections. The latter is a combination tool having a rethreading tap and a broached socket that can be used for screwing the fittings in or out. It comprises three tools in one.

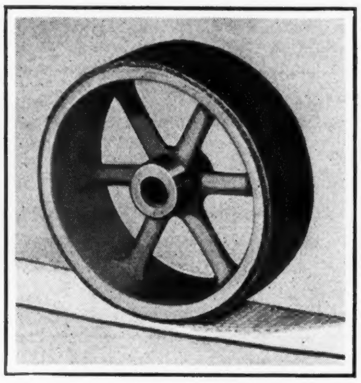
Cutler-Hammer Explosion-Proof Starter

An explosion-proof, across-the-line, automatic starter for alternating-current squirrel-cage induction motors is shown in the accompanying illustration. This starter is a recent addition to the line of electrical equipment manufactured by Cutler-Hammer, Inc., 1295 St. Paul Ave., Milwaukee, Wis., and is intended for installations where Duco paint, lacquers, gasoline, alcohol, etc., may be used.



Cutler-Hammer Explosion-proof Starter

The thermal overload mechanism is of a new design and is immersed in oil. It is used with the contactor. The contacts open under a 6-inch head of oil. The float-operated indicator shows the oil levels. Being completely immersed in oil, the starter resists corrosion.



Small Pulley with Gripwell Duktex Canvas Covering

Gripwell Pulley Covering and Compound

A new method of preventing belt slippage has been made available by the Gripwell Mfg Co., 110 W. 34th St., New York City. This method consists of cementing a special canvas known as Duktex around the periphery of the pulley through the use of Gripwell cement. This compound is also applied lightly to the canvas covering about twice a month.

The result is a pulley surface that is readily gripped by leather, rubber, or woven belts so that slippage is eliminated. Belts can be run slack in order to obtain a large arc of contact. The Gripwell cement contains no sticky or gritty substances that might be harmful to belts. However, it does contain both neatsfoot and castor oil which lubricate the belts and prolong their lives.

The Duktex canvas can be supplied in any width or length to meet requirements. Its application is easy, and once applied, the canvas will adhere to the pulley until worn out. A small pulley provided with this covering is shown in the illustration.

Sheet-Metal Tester

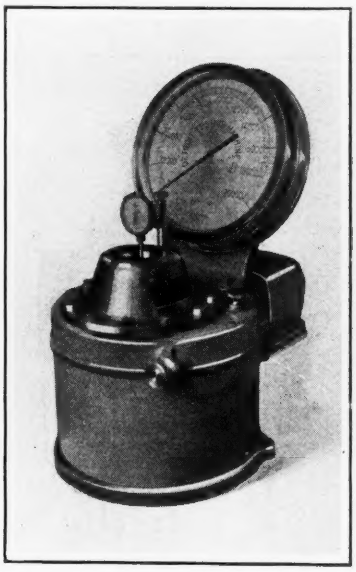
In a device intended for testing the drawing qualities of sheet metal, which has recently been introduced on the market by the Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit, Mich., the material is clamped

hydraulically and from underneath. With the hydraulic method, the clamping pressure is always in proportion to the load applied and the metal is clamped with ease. Also, there is no possibility of the grips being forced apart in a manner that would permit the metal to draw under.

Oil is used as the pressure medium, the load being applied by a motor-driven pump of the gear type. The motor is of ball-bearing design and drives direct through gears. This drive is installed within the casing, which also serves as the oil reservoir.

Safety devices guard against overloading and over-travel. The grips are of the circular type. They are easily removed without tools when necessary. The 12-inch manometer on standard machines has large graduations and thus permits fine readings. For tests requiring unusual accuracy on light material and a large gage capacity, two manometers can be provided, one being graduated from 0 to 5000 or 10,000 pounds, depending on the nature of the work, and the other graduated up to the capacity of the machine.

Two standard sizes of this tester are available, with load capacities of 10,000 and 20,000 pounds. Machines with capacities above 20,000 pounds can be built to specification.



Testing Device for Determining the Drawing Qualities of Sheet Steel

Beaver Portable Pipe Machine

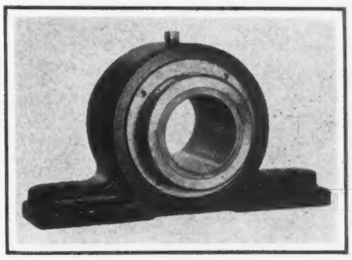
A portable machine that will cut, thread, and ream 1/2- to 2-inch pipe has been added to the line of Beaver tools made by the Borden Co., Warren, Ohio. This Model A machine is intended for handling steel, wrought-iron, brass, or cast-iron pipe. Three opening die-heads are supplied, the dies of which can be adjusted over or under standard. It is not necessary to back off the die over finished threads. The die-head can be conveniently tilted back out of the way to permit cutting and threading pipe up to 12 inches, through the use of a universal shaft and geared die-stocks and pipe cutters.

Portable Pipe Cutting, Threading and Reaming Machine

This equipment is driven by a 1/2-horsepower universal motor which can be reversed by manipulating the switch. The motor operates from a 110-volt lighting circuit. The oil-pump of this equipment is mounted on the outside for convenient cleaning, repacking, etc. As all main housings are made of aluminum, there has been a saving of 125 pounds in weight, the net weight being 330 pounds.

Shafer Normal-Duty Roller-Bearing Units

A new series of self-aligning roller-bearing units intended for normal-duty applications has been placed on the market by the Shafer Bearing Corporation, 6501-99 W. Grand Ave., Chicago, Ill. This line includes pillow blocks, flange units, and take-up units in a full range of shaft sizes from 3/4 to 3 inches. The units embody the same double-row, self-aligning roller bearings as the standard-duty line described in the March, 1928, number of MACHINERY, page 560, but the housings are simpler and of lighter weight.



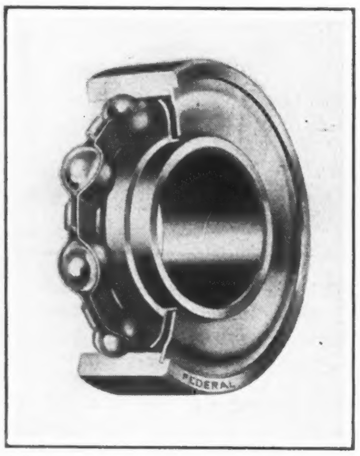
Shafer Roller-bearing Pillow Block Intended for Normal-duty Service

As will be seen from the illustration, the inner race of the bearing in units of the new line is extended on one end only and fastened to the shaft by a special locking collar. There is a grease seal, consisting of two steel stampings pressed into the housing or cover. Between these stampings is a fiber washer which is a slip fit on the extended cone. This seal excludes dirt and other abrasive materials, and at the same time, retains lubrication and prevents leakage.

The flange units can be bolted to the side of a machine frame, while the take-up units are suitable for conveyors and other applications in which a belt take-up bearing is required.

Federal Vacuum-Seal Ball Bearing

A Vacuum-Seal ball bearing of all-metal design is being introduced on the market by the Federal Bearings Co., Inc., Poughkeepsie, N. Y. The inner impeller and outer seal of this bearing form a vacuum pocket that prevents foreign matter from being sucked into the bearing. The impeller is securely

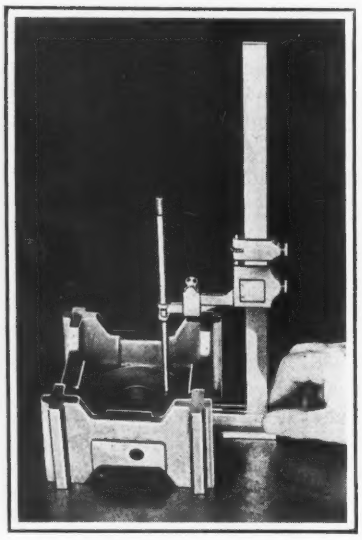


Federal Vacuum-Seal All-metal Ball Bearing

pressed on the inner bearing ring, while the outer seal is spun into a recess in the outer race ring. The impeller constantly throws grease into the races and on the balls, and the vacuum retains the grease. This ball bearing is made to S.A.E. standard dimensions.

Brown & Sharpe Height Gage Attachments

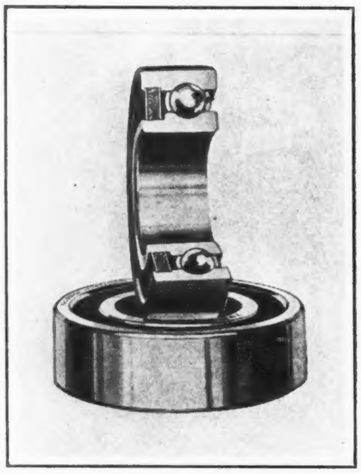
The Brown & Sharpe Mfg. Co., Providence, R. I., has recently brought out two attachments, the No. 585A and the 585B for use with the No. 585 vernier height gages of both the 10- and 18-inch heights. These attachments are easily locked on the height gage by means of a clamp screw as illustrated. The application of one of them quickly converts the height gage into an accurate depth gage for taking measurements over high projections as well as into deep recesses.



Height Gage with Attachment for Measuring Depths

Norma-Hoffmann Self-Protected Ball Bearings

Enclosed type ball bearings with a felt seal, designated as the 7000 series, have been added to the line of ball and roller bearings manufactured by the Norma-Hoffmann Bearings Corporation, Stamford, Conn. These new bearings have wide, solid inner and outer rings, designed to provide maximum contact on the shaft and in the housing. Their design is such that they can be clamped on both sides. They will carry substantial thrust loads in either direction in combination with the radial load.



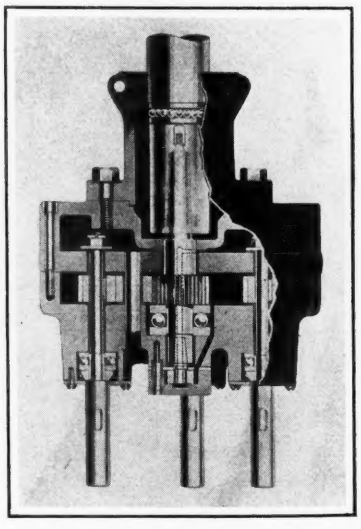
Norma-Hoffmann Ball Bearing with Felt Seal

The Greaseal feature consists of a felt washer and a thin fiber ring interposed between split snap rings that are securely held in a groove in the outer ring. The inner ring is recessed to provide a shoulder which, in combination with the felt washer, forms a labyrinth as an added safeguard against the escape of lubricant. There is ample space for grease. These ball bearings are made in a full range of sizes.

Pioneer Multiple-Spindle Drill Heads

Automatic force-feed lubrication is the principal feature of the multiple-spindle drill heads which have recently been brought out by the Pioneer Engineering & Mfg. Co., Inc., 8316 Woodward Ave., Detroit, Mich. The lubricant is supplied by a built-in Rollway pump and floods every moving part. This pump is self-priming and starts the flow of oil when the machine is started. It has only two moving parts and is driven direct by the main drive shaft or by an idler shaft, as may be required by the design of the individual head.

These drill heads are constructed for convenient application to various makes and sizes of machines. They are made in two types. The Type A illustrated is especially adapted to jobs where close centers or staggered gears are necessary. The Type B is intended for application where a minimum head space is available. Heads can be supplied for drills from No. 60 to 1 1/16 inches in diameter. Three types of spindle noses are available—a plain nose, a tapping nose, and an adjustable nose.



Drill Head with Automatic Force-feed Lubrication System

Covel Universal Cutter and Tool Grinder

The Covel Mfg. Co., Benton Harbor, Mich., has placed on the market a universal cutter and tool grinder in which the grinding-wheel spindle runs in initial-loaded ball bearings, thereby making it as accurate for cup-wheel grinding as for grinding on the periphery of plain wheels. The motor for driving the grinding wheel is mounted on the base of the one-piece column. It drives, by V-belts, the cone pulley of a ball-bearing countershaft, also located in the base. A V-belt transmits the drive from this countershaft up through the center of the column to the grinding-wheel spindle. Three speeds are available for this spindle, namely, 3200, 4500, and 5800 revolutions per minute.

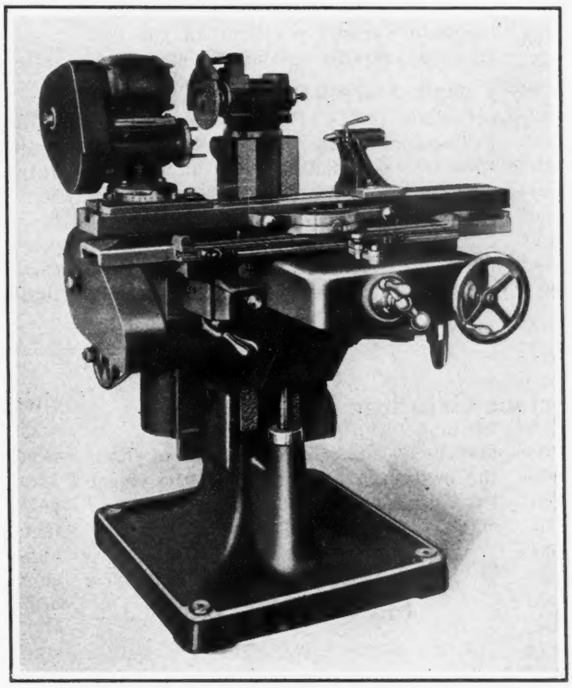
The grinding-wheel head swivels 110 degrees to the right and left, and is graduated in degrees. Cup-wheel grinding can be performed with the wheel on either end of the spindle.

The saddle is provided with a 1 1/8-inch diameter cross-feed screw having ten threads per inch. This construction gives a cross-feed that is unusually sensitive for accurate cylindrical grinding. The machine can be furnished either with hand or with power feed affording eight changes. All controls and handwheels are conveniently located, and the table feed can be operated by hand from either the front or rear.

The headstock is of a three-speed, self-contained motor-driven type. It is provided with a magnetic brake and has a swivel base. The headstock spindle runs in Timken bearings. It has a Brown & Sharpe No. 12 taper socket to accommodate spring collet chucks. Work can be driven on either live or dead centers.

A universal face-milling cutter grinding attachment designed to take arbors having the National Standard milling-spindle taper can be supplied for use with this machine. This attachment is provided with reducing collets having B. & S. Nos. 10 and 11 taper sockets. It can be swiveled in vertical and horizontal planes, and is graduated in both directions. Other equipment includes a swivel vise, gear-cutter grinding attachment, internal grinding attachment, radius grinding attachment, and radius wheel-dresser. There is also a surface grinding attachment of new design, having an over-arm that carries the wheel-spindle in ball bearings located close to the wheel, instead of having the usual spindle extension.

In designing this machine, care has been taken to protect moving parts from abrasives and to insure proper lubrication.



Universal Cutter and Tool Grinder Built by the Covel Mfg. Co.

Maintenance of Wages and Cost Reductions

The recent action of the United States Steel Corporation in reducing dividends rather than wages has created a great deal of comment. Dealing with this subject, the *Business Bulletin* of the LaSalle Extension University points out that, according to the 1929 Census of Manufactures, wages paid out by all the manufacturing concerns of the country amount to 16.5 per cent of the total value of their products, so that a general wage reduction of 10 per cent would affect the total value by less than 2 per cent. It is questioned whether this amount of cost reduction could not be obtained more effectively by some other means than cutting wages.

The opinion is further voiced that experienced business managers know that wage cuts hurt the morale of employes, and their effect on production costs is worth careful consideration. Wage cuts not only increase the danger of serious strikes and labor disturbances, but they create a tendency on the part of the workmen to restrict output in order to make the work last longer. The net results may well be that no saving is made in actual labor cost through general wage reductions.

* * *

Some of the leading steel companies are now rolling sections weighing 152 pounds, which is 22 pounds heavier than the heaviest section formerly used. The first rails rolled are for the Pennsylvania Railroad, and are designed to carry trains with axle loads of 100,000 pounds at a speed of 100 miles per hour. The maximum capacity of the 130-pound rail is 80,000 pounds axle load at 80 miles an hour.

Personals

Tom E. Lord has been appointed machine tool representative for the state of Michigan by the National Tool Co., Cleveland, Ohio. Mr. Lord will handle the National-Cleveland line of machine tools from his office in the First National Bank Bldg., Detroit, Mich.

C. A. Macfie has been appointed assistant sales manager of Revere Copper & Brass, Inc., 230 Park Ave., New York City. Mr. Macfie has been identified with the copper and brass business since 1912, and has previously been connected with the U. T. Hungerford Brass & Copper Co. and the Rome Brass & Copper Co., now known as the Rome Division of Revere Copper & Brass, Inc.

J. C. Nicholls has been promoted from general manager of the International Nickel Co. of Canada, Ltd., at Copper Cliff, to assistant to the president at Toronto. Donald MacAskill has been promoted from manager of the mining and smelting division to the position of general manager at Copper Cliff. Dr. John F. Thompson, assistant to the president, has been appointed vice-president.

Frank Crofford Rushing, Pittsburgh, Pa., has received the Lamme memorial scholarship award from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., which will enable him to continue his engineering studies at Charlottenburg, Germany. This scholarship was established by the Westinghouse Electric & Mfg. Co. as a memorial to its late chief engineer, Benjamin Garver Lamme.

T. R. Langan has been appointed northeastern district manager of the Westinghouse Electric & Mfg. Co., with headquarters in New York City. Mr. Langan has been with the Westinghouse company for more than twenty years, having started as an apprentice in the engineering department and later having held various positions in the construction, service, and sales departments.

Major Aaron E. Carpenter, first vice-president of E. F. Houghton & Co., Philadelphia, Pa., has just returned from a two months' stay in Europe. During his visit, Major Carpenter inspected the newly constructed Houghton oil manufacturing plant at Trafford Park, near Manchester, England. Trafford Park is already the site of some thirty American manufacturing plants, warehouses, and distributing branches.

R. R. Davis who has directed, for the last twenty-one years, various Westinghouse advertising activities, has been appointed apparatus advertising manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Davis became associated with the company in 1905, immediately following his graduation from the electrical engineering course at the Western University of Pennsylvania. After a course in engineering apprentice work at East Pittsburgh, he went to Philadelphia as advisory engineer and salesman, and in 1910 joined the Westinghouse advertising department. In 1925, he was made assistant manager of the department.

Obituary

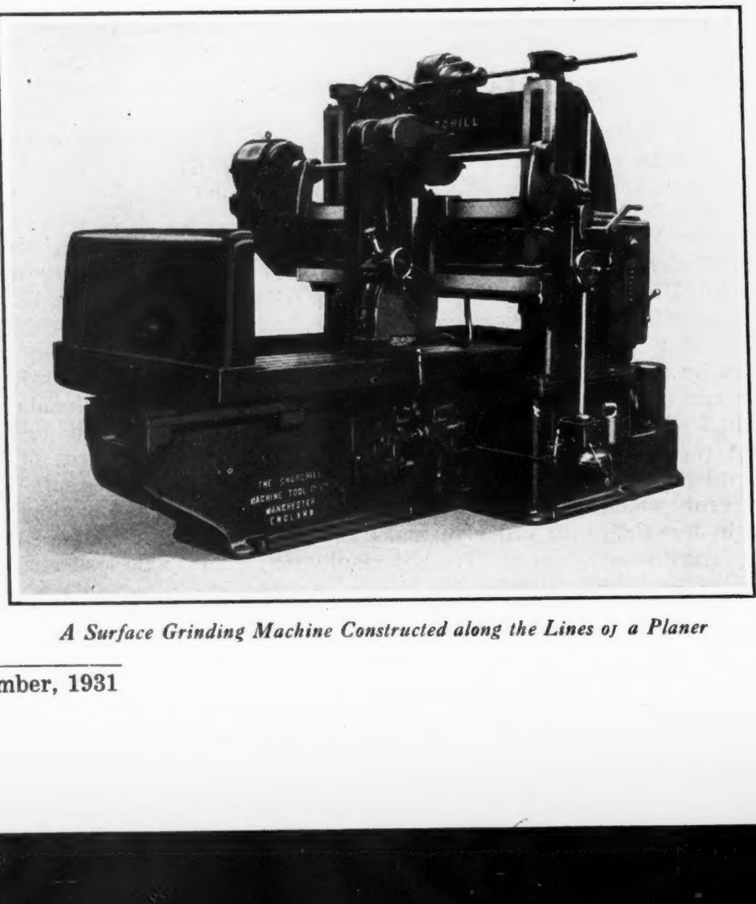
Elmer E. Aring, purchasing agent of the Foote-Burt Co., Cleveland, Ohio, died July 27 at the age of thirty-eight years. Mr. Aring had been purchasing agent for the Foote-Burt Co. for thirteen years. He was also secretary of the Cleveland Purchasing Agents' Association during 1928 and 1929.

A Planer Type Surface Grinding Machine

A planer type surface grinding machine in which the table is actuated hydraulically is a recent development of the Churchill Machine Tool Co., Ltd., Broadheath, Manchester, England. This machine represents a departure from previous planer type grinders built by this concern in that the grinding wheel is mounted on a horizontal spindle. In previous machines, the wheel was held on a vertical spindle, although an auxiliary attachment permitted it to be carried on a horizontal spindle as well.

Separate motors are provided for driving the various units of the new machine, and there is an integral push-button control panel for all motors. The machine illustrated has a table width of 27 inches and a length of 6 feet.

In the operation of this machine, the wheel-head can be set to move automatically in a transverse direction at each extremity of the table stroke. This cross-movement may also be obtained by hand. Vertical feeding of the wheel can also be effected automatically or by hand. The automatic feeding movement comes into operation at either the beginning or the end of the wheel-head cross-movement.



A Surface Grinding Machine Constructed along the Lines of a Planer

* * *

June Machinery Exports Show Large Gain

A decided upward turn occurred in the exports of industrial machinery during June, according to statistics published by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce. The total exports of industrial machinery for June were valued at $15,668,000, as compared with $12,494,000 during May. In fact, the June total was the highest for any month since July, 1930, at which time the machinery industry was first beginning to seriously feel the effects of the world-wide depression. The substantial increase in the June exports is encouraging, since these exports have remained at from $12,000,000 to $13,000,000 for several months.

Perhaps the most noteworthy feature in the June export figures was the sharp increase in shipments of metal-working machinery. The metal-working machinery exported in June amounted to $5,283,000, as compared with $3,075,000 in May, and $3,690,000 in June, 1930. In fact, the figure for June, 1931, was 55 per cent greater than the average monthly figure during the boom year of 1920.

* * *

Hot weather provided a boon to air lines. Travel during July showed an increase of 40 per cent on certain lines.

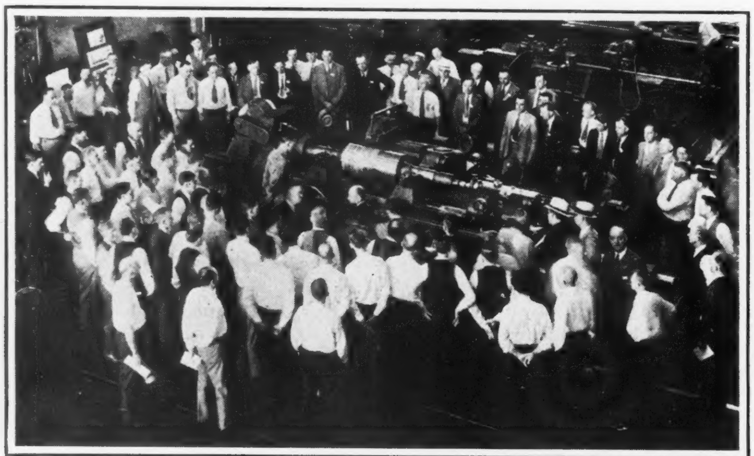
News of the Industry

KINITE CORPORATION, Milwaukee, Wis., has opened a new foundry at Fairmont, W. Va., for the manufacture of electric furnace iron castings for glass plants.

EX-CELL-O AIRCRAFT & TOOL CORPORATION, Detroit, Mich., announces the appointment of Erskine & Rosche Co., Minneapolis, Minn., as a manufacturer's representative, handling the company's complete line of products.

CINCINNATI MILLING MACHINE CO. and CINCINNATI GRINDERS, INC., Cincinnati, Ohio, have issued a booklet entitled "Come and See Us," containing an invitation to visit the companies' plants and featuring illustrations of different departments.

DURABILT STEEL LOCKER CO., Aurora, Ill., announces the election of the following officers: E. D. Kaser, president and general manager; V. C. Kaser, vice-president; H. S. Hatch, treasurer and manager of sales; W. H. Graham, secretary. All the officers have been interested in the Durabilt Steel Locker Co. practically since its inception and have largely been responsible for the design, manufacture, and marketing of its products.



A Group of Visitors in the Plant of the Cincinnati Grinders, Inc., Viewing a Demonstration of the Company's 24- by 120-inch Roll Grinder

BABCOCK & WILCOX CO., 85 Liberty St., New York City, announces that Fred Sprinkman & Sons, 116 S. 2nd St., Milwaukee, Wis., have been appointed distributors of the company's No. 80 refractory mortars and plastics for that district.

NORMA-HOFFMANN BEARINGS CORPORATION, Stamford, Conn., manufacturer of precision ball, roller, and thrust bearings, has opened a sales office at 1014 American Bank Bldg., Parkway and Walnut St., Cincinnati, Ohio. C. D. Kilham, for many years sales engineer with the company, has been made manager of the new office.

BAKELITE CORPORATION, 247 Park Ave., New York City, has appointed Martin, Hoyt & Milne, Merchants Exchange Bldg., San Francisco, Calif., agent for Bakelite products for varnish manufacturers in the West Coast territory. The Electrical Specialty Co., 1575 Folsom St., San Francisco, retains the agency in the Pacific coast territory for all other Bakelite products.

STEDMAN'S FOUNDRY AND MACHINE WORKS, Aurora, Ind., have appointed representatives as follows: Goggin & Mills, 407 S. Dearborn St., Chicago, Ill.; Louis Mardaga, 710 Park Bldg., Pittsburgh, Pa.; J. Y. Riffe, 811 Peoples Bank Bldg., Charleston, W. Va.; S. D. Calloway, 3029 Roanoke Road, Kansas City, Mo.; and Brown, Fraser & Co., Ltd., 1150 Homer St., Vancouver, British Columbia.

FAY & SCOTT, Dexter, Me., has published an attractive booklet commemorating the fiftieth anniversary of the founding of the company in 1881 by Norman H. Fay and Walter Scott. The company began by manufacturing wood-turning lathes, but has since manufactured metal-turning lathes, machine tools, and special machinery, and during recent years has become prominent in the manufacture of canning machinery.

SIMPLEX CORPORATION, Woonsocket, R. I., has taken over the SIMPLEX TOOL CO. The new company will specialize in the manufacture of the Simplex line of steel slide vises developed by the old company in 1924. It will manufacture the Simplex machinists' vise, coach-makers' and combination pipe vises, and the new production foot-operated vise, as well as the Simplex utility line of home and garage vises. The personnel of the new company remains the same.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., announces that the corporation has acquired the manufacturing and marketing facilities of METALWELD, INC., Philadelphia, Pa., builder of a complete line of portable compressor units. This places the Worthington Pump & Machinery Corporation in a position to supply all air equipment requirements of contractors, railroads, public utilities, and industrial users.

EUCLID CRANE & HOIST CO. and ARMINGTON ENGINEERING CO. have approved a plan of merger whereby the manufacturing facilities and engineering experience of the two companies are combined in the Euclid Crane & Hoist Co., whose name has now been changed to the EUCLID-ARMINGTON CORPORATION, Euclid, Ohio. The corporation will build a complete line of electric and hand operated cranes for all classes of service, in capacities from 1/2 to 100 tons, and a full line of electric hoists, trolleys, winches, etc., in capacities from 1/4 to 20 tons.

CINCINNATI MILLING MACHINE CO. and CINCINNATI GRINDERS, INC., Cincinnati, Ohio, manufacturers of milling and grinding machines, announce that as a result of the increasing demands from users of machine tools for technical service direct from the plant, the companies will establish direct sales representation in Detroit, Chicago, Cleveland, and Cincinnati. Technically trained and thoroughly experienced engineers on milling and grinding methods will serve the manufacturing industries in these territories. Offices will shortly be opened in Cleveland, Detroit, and Chicago. In all other territories, dealers will be maintained and direct factory representatives will work in conjunction with the dealers.

COVEL-HANCHETT CO., Big Rapids, Mich., manufacturer of industrial grinding machines, several months ago made the following change in sales policy: The Badger line of disk grinders and face grinders are now manufactured and sold by the Hanchett Mfg. Co., Big Rapids. The line of tool-room grinding machines, including precision surface grinders and universal cutter and tool grinders, previously known as the Wilmarth & Marmon machines, and also the Yankee twist drill grinders, are now being manufactured and sold by the Covel Mfg. Co., Benton Harbor, Mich. The purpose of this change was to bring the sales of the two lines closer to the point of manufacture, and also to simplify dealer arrangements.

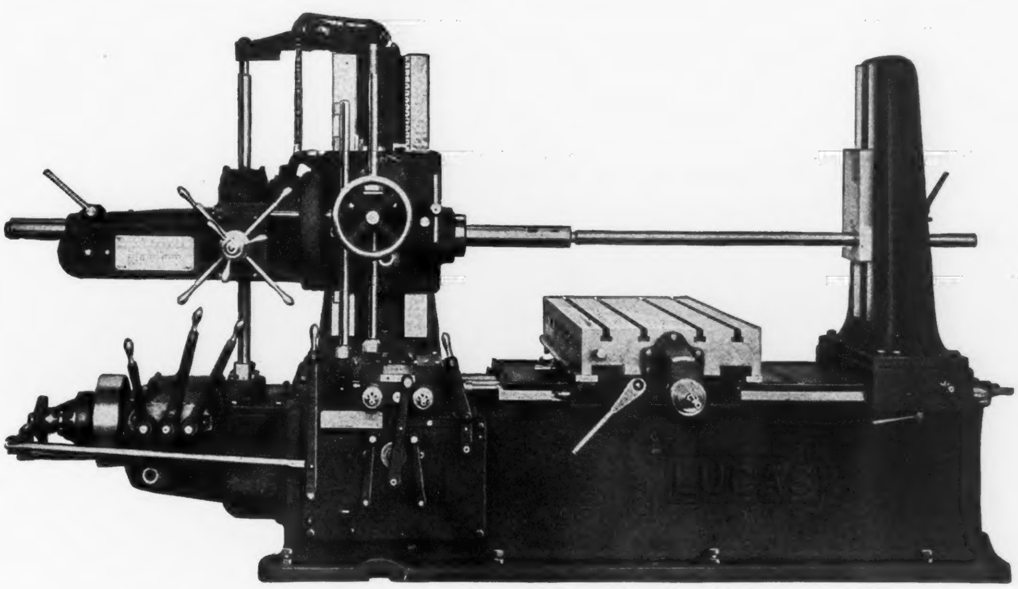
GENERAL MACHINERY CORPORATION, Hamilton, Ohio, announces that the corporation has acquired the business of the PUTNAM MACHINE CO., Fitchburg, Mass., formerly owned by Manning, Maxwell & Moore, Inc. The Putnam line of products will be manufactured at the plants of the General Machinery Corporation as supplementary to the line of machines manufactured by the Niles Tool Works Co., Hamilton, Ohio, another subsidiary of the General Machinery Corporation. The company is prepared to furnish repairs for all Putnam, Dietrich & Harvey, and Beaman & Smith equipment. The business will be conducted as the Putnam Machine Co., Division of General Machinery Corporation. G. A. Rentschler, president of the General Machinery Corporation, is also president of the Putnam Machine Co.

IMPROVED QUALITY

justifies replacement
—in fact, it *demands* it

Disregarding, for the moment, the increased production made possible by higher speeds, greater power and rigidity available in the new LUCAS, you cannot afford to continue in operation an old machine, worn throughout and lacking the rigidity to maintain alignment under stress of heavy cuts, or work requiring long range of adjustment of the table and spindle head.

Pieces inaccurately machined on such an old machine require costly hand fitting with consequent delay, are not interchangeable, and injure your reputation, which is expensive all round.



a modern LUCAS

"Precision" Horizontal Boring, Drilling and Milling Machine

will do BETTER WORK and MORE OF IT

Now is the time for action! When may our representative call?

THE LUCAS MACHINE TOOL COMPANY, Cleveland, O.

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. Andrews & George Co., Tokyo. Catmur Machine Tool Corp., Ltd., London, Eng. M. Kocian & G. Nedela, Prague. V. Lowener, Copenhagen, Oslo, Stockholm. Emanuele Mascherpa, Milan, Italy. R. S. Stokvis & Zonen, Rotterdam, Paris.

Coming Events

SEPTEMBER 17—Fall meeting of the Steel Founders' Society of America, Inc., in Chicago, Ill. Managing director, G. P. Rogers, 932 Graybar Bldg., New York City.

SEPTEMBER 21-25—Annual meeting of the American Society for Steel Treating and National Metal Exposition to be held at the Commonwealth Pier, Boston, Mass. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 28-30—Convention of the American Association of Engineers at Huntington, W. Va. Secretary, M. E. McIver, 8 South Michigan Ave., Chicago, Ill.

OCTOBER 7-8—Production meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. R. S. Burnett, Director, Production Activity, 29 W. 39th St., New York City.

OCTOBER 12-16—Thirteenth annual convention and exhibition of the American Gas Association at Atlantic City, N. J. For further information, address J. B. Nealey, American Gas Association, 420 Lexington Ave., New York.

OCTOBER 13-16—Twenty-fifth annual convention of the Illuminating Engineering Society at the William Penn Hotel, Pittsburgh, Pa. For further information, apply to the secretary, Illuminating Engineering Society, 29 W. 39th St., New York City.

OCTOBER 14-16—Eighteenth national convention of the Society of Industrial Engineers to be held at the Fort Pitt Hotel, Pittsburgh, Pa. Secretary's office, 205 W. Wacker Drive, Chicago, Ill.

OCTOBER 15-16—Fourth annual convention of the Gray Iron Institute at the West Baden Springs Hotel, West Baden Springs, Ind. Manager, Arthur J. Tuscany, Terminal Tower Bldg., Cleveland, Ohio.

OCTOBER 15-17—Semi-annual meeting of the American Gear Manufacturers' Association to be held at the William Penn Hotel, Pittsburgh, Pa. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

OCTOBER 27-29 (date changed from NOVEMBER 10-12)—National Transportation Meeting of the Society of Automotive Engineers at the Shoreham Hotel, Washington, D. C. Robert S. Burnett, Director, Transportation and Maintenance Activity, 29 W. 39th St., New York City.

NOVEMBER 30-DECEMBER 4—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies' Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

NOVEMBER 30-DECEMBER 5—First National Exposition of Mechanical Handling Equipment to be held at the Grand Central Palace, New York City. Charles F. Roth, Manager, International Exposition Co., Grand Central Palace, New York City.

New Catalogues and Circulars

PUMPS. Pomona Pump Co., Pomona, Calif. Bulletin 16-A, descriptive of turbine pumps for all types of industrial service.

DUST FILTERS. W. W. Sly Mfg. Co., Cleveland, Ohio. Bulletin S-80, describing the company's new dust filter development for industrial purposes.

WELDING MACHINES. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 20522, illustrating and describing the Flex-Arc alternating-current welder.

SHEET STEEL. Inland Steel Co., Chicago, Ill. Booklet entitled "Inland Open-hearth Sheet Steel Products," containing all the information ordinarily needed in ordering steel sheets.

FIRST-AID EQUIPMENT. Mine Safety Appliances Co., Homewood Station, Pittsburgh, Pa. Catalogue FA-2, covering a complete line of first-aid equipment and kits for industrial use.

WELDED GEAR BLANKS. Lukenweld, Inc., Coatesville, Pa. Circular illustrating and describing gear blanks of welded construction made in sizes from 24 inches in diameter and upward.

PRESSES. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Catalogue illustrating and describing typical examples of Niagara power presses and squaring shears.

NICKEL ALLOY STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Pamphlets Nos. 1 to 8, giving recommended specifications for nickel alloy steel for railroad applications.

SPEED REDUCERS. W. A. Jones Foundry & Machine Co., 4401 Roosevelt Road, Chicago, Ill. Bulletin 53, illustrating and describing Herringbone-Maag speed reducers for small motor drives.

X-RAY EXAMINATIONS. Robert W. Hunt Co., 2200 Insurance Exchange, Chicago, Ill. Circular announcing the Hunt laboratory X-ray service for the determination of quality in engineering materials.

DIE-SETS. Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill. First issue of a monthly magazine entitled "Danly Guide Post," featuring articles for die designers and draftsmen, and diemakers.

CUTTING OIL. Sun Oil Co., Philadelphia, Pa. Booklet entitled "Cutting and Grinding Facts," illustrating and describing successful machining operations for which the company's emulsifying cutting oil is used.

BABBITT. Bunting Brass & Bronze Co., Toledo, Ohio. Circular entitled "Ten Points of Superiority." The circular also gives the physical properties of Bunting babbitt, and lists the applications for which it is best suited.

WELDING EQUIPMENT. Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin W, containing data on welding rod and equipment. The material covers gas and electric welding rods, and oxy-acetylene and electric welding equipment.

INDICATING AND RECORDING INSTRUMENTS. Brown Instrument Co., Philadelphia, Pa. Folder entitled "Bringing Laboratory Accuracy to Industry," showing the principal features of the new Brown potentiometer pyrometer.

HYDRAULIC LUBRICATING SYSTEM. Lubrication Devices, Inc., Battle Creek, Mich. Folder illustrating and describing the new Farval Type C automatic system of lubrication, which can be readily adapted to practically all types of machines.

TAPS. Morse Twist Drill & Machine Co., New Bedford, Mass. Tap manual containing useful information relative to the construction of various styles of taps and methods of use. A valuable section of the booklet deals with lubrication for tapping.

GASKETS AND PACKING. Victor Mfg. & Gasket Co., 5750 W. Roosevelt Road, Chicago, Ill. Catalogue H, comprising a reference manual containing nearly 100 pages of data concerning gaskets, gasket materials, and packings for industrial and commercial uses.

BALL BEARINGS. Fafnir Bearing Co., New Britain, Conn. Booklet entitled "Typical Mountings for Ball Bearings," containing numerous illustrations with descriptive text of approved ball-bearing mountings, which may be used as valuable suggestions for the designer.

CARBOLOY TIPPED TOOLS. Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich. Catalogue C-231, illustrating and describing the different types of Ex-Cell-O Carboloy tipped tools. In addition to the standard line, a number of tools for special application are shown.

CHAIN DRIVES. Morse Chain Co., Ithaca, N. Y. Bulletin 44, covering Morse stock chain drives up to 50 horsepower. Chain cases, sprockets, hunting links, and installation and lubrication data are also given. The catalogue is a fine example of good typography and printing.

GEAR-CUTTING AND GRINDING MACHINERY. National Tool Co., Madison Ave. at W. 112th St., Cleveland, Ohio. Machinery bulletin briefly describing and illustrating universal gear shapers, worm-wheel generating machines, spur gear grinding machines, spur and helical gear grinding machines, and gear checking machines.

VARIABLE-SPEED TRANSMISSION. Reeves Pulley Co., Columbus, Ind. Folder illustrating and describing the Reeves Vari-speed motor pulley, which is mounted on the motor shaft and forms the driving element between the motor and the driven shaft. By turning a handwheel, any desired speed within the range of the device may be easily secured and maintained.

ROLL GRINDING MACHINES. Farrel-Birmingham Co., Inc., Ansonia, Conn. Booklet 107 entitled "Assuring Production with Precision in Roll Grinding." The booklet explains the necessity for close accuracy and fine finish in rolls used for the manufacture of various products made from metal, paper, rubber, etc., and how these qualities can be obtained. The mechanical features of roll grinding machines are also described.

BALL AND ROLLER BEARINGS. Bantam Ball Bearing Co., South Bend, Ind. Ball and roller bearing manual No. 11, containing complete data on the Bantam line of ball and roller bearings. The catalogue is provided with a thumb index so that the various sections can be readily referred to. It is divided as follows: Ball thrust bearings, roller thrust bearings, journal roller bearings, ball radial bearings, roller radial bearings, special bearings, steels, and engineering data.

PRECISION BORER. Societe Genevoise d'Instruments de Physique, Geneva, Switzerland. (R. Y. Ferner Co., Investment Bldg., Washington, D. C., American representative.) Catalogue 534, describing the latest model of Type MP-3C Sip borer for the locating, drilling, boring, and checking of precision work. New features of the machine include drive by motor mounted vertically on the side of the machine, increased height below the cross-rail, and greater range of boring and drilling speeds.

ELECTRIC MOTORS. Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, Ohio. Circular describing and giving dimensions of Ohio ball bearing motors for slow speed or torque application. One of the principal features of these motors is that they can be stalled across the line with the current on for several hours at a time without overheating or harming the motor. Several different types are made, one of which may be locked across the line for 24 hours (continuous service) without injury to the motor.